STANDARDS CORRELATION

OpenSciEd provides a comprehensive curriculum. It addresses the core elements as integrated across performance objectives in each grade and course. Instructional materials provide a coherent path anchored in students' own experiences and questions to build disciplinary core ideas and crosscutting concepts through an iterative process of questioning, investigating, modeling, and constructing explanations.

Students experience learning as meaningful (making sense of ideas rather than just reproducing them), cumulative (learning challenges require them to use and build on what they figured out in previous lessons), and progressive (the class improves explanations or solutions over time by iteratively assessing them, elaborating on them, and holding them up to critique and evidence).

OpenSciEd provides relevant and rigorous instruction that emphasizes student mastery of both disciplinary core ideas (concepts), application of science and engineering practices (skills) and cross cutting concepts (themes), to support student readiness for citizenship, college, and careers.

OSE equips students with sufficient knowledge of science and engineering to become effective consumers of scientific and technological information to face the ever-changing workforce of today's world. This aligns with the Mississippi College and Career Readiness Standards for Science.

EdReports "All-Green" Rated ✅

The Activate Learning Certified Version of OpenSciEd 6-8 curriculum has earned the esteemed "all-green" rating from EdReports, a leading nonprofit organization that evaluates instructional materials for alignment to college and career ready standards and other markers of quality.

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OpenSciEd CERTIFIED Activate Learning VERSION

Key: A=Lesson, L=Lesson, R=Reading, AL=Appendix Lesson

MS-PS1 Matter and its Interactions

NGSS Performance Expectation (PE) and Disciplinary Core Ideas (DCI)	OpenSciEd
PE **MS-PS1-1** Develop models to describe the atomic composition of simple molecules and extended structures	**7.1 Chemical Reactions and Matter: Bath Bombs** **7.3 Metabolic Reactions**
DCI **PS1.A Structure and Properties of Matter** ● Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms.	**7.1 Chemical Reactions and Matter: Bath Bombs** Lesson 1, Lesson 2, Lesson 7, Lesson 10, Lesson 11, Lesson 12, Lesson 14 **7.3 Metabolic Reactions** Lesson 3, Lesson 4, Lesson 10, Lesson 13, Lesson 14, Lesson 15
DCI **PS1.A Structure and Properties of Matter** ● Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals).	**7.1 Chemical Reactions and Matter: Bath Bombs** Lesson 1, Lesson 12
PE **MS-PS1-2** Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.	**7.1 Chemical Reactions and Matter: Bath Bombs** **7.3 Metabolic Reactions**
DCI **PS1.A Structure and Properties of Matter** ● Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it.	**7.1 Chemical Reactions and Matter: Bath Bombs** Lesson 1, Lesson 3, Lesson 4, Lesson 5, Lesson 6, Lesson 7, Lesson 8, Lesson 9, Lesson 10, Lesson 11, Lesson 12, Lesson 13
PS1.B Chemical Reactions ● Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants.	**7.1 Chemical Reactions and Matter: Bath Bombs** Lesson 1, Lesson 2, Lesson 3, Lesson 4, Lesson 6, Lesson 7, Lesson 8, Lesson 9, Lesson 10, Lesson 11, Lesson 12, Lesson 14 **7.3 Metabolic Reactions** Lesson 2, Lesson 3, Lesson 5, Lesson 6, Lesson 7, Lesson 10, Lesson 11, Lesson 13, Lesson 14, Lesson 15

	7.4 Matter Cycling and Photosynthesis
PE **MS-PS1-3** Gather and make sense of information to describe that synthetic materials come from natural resources and impact society	**7.4 Matter Cycling and Photosynthesis**
DCI **PS1.A Structure and Properties of Matter** ● Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it.	**7.4 Matter Cycling and Photosynthesis** Lesson 1, Lesson 3, Lesson 9, Lesson 10
PS1.B Chemical Reactions ● Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants.	**7.4 Matter Cycling and Photosynthesis** Lesson 6, Lesson 7, Lesson 9, Lesson 10, Lesson 11, Lesson 14, Lesson 15
PE **MS-PS1-4** Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.	**6.2 Thermal Energy: Cup Design** **6.3 Weather, Climate, and Water Cycling: Storms**
DCI **PS1.A Structure and Properties of Matter** ● Gases and liquids are made of molecules or inert atoms that are moving about relative to each other.	**6.2 Thermal Energy: Cup Design** Lesson 4, Lesson 5, Lesson 6, Lesson 11 **6.3 Weather, Climate, and Water Cycling: Storms** Lesson 3, Lesson 4, Lesson 5, Lesson 6, Lesson 7, Lesson 8
PS1.A Structure and Properties of Matter ● In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change relative locations.	**6.2 Thermal Energy: Cup Design** Lesson 4, Lesson 5, Lesson 6, Lesson 13 **6.3 Weather, Climate, and Water Cycling: Storms** Lesson 3, Lesson 4, Lesson 5, Lesson 6, Lesson 7, Lesson 8
PS1.A Structure and Properties of Matter ● The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter.	**6.2 Thermal Energy: Cup Design** Lesson 4, Lesson 5, Lesson 6 **6.3 Weather, Climate, and Water Cycling: Storms** Lesson 8
PS3.A: Definitions of Energy ● The term “heat” as used in everyday language refers both to thermal energy (the motion of atoms or molecules within a substance) and the transfer of that thermal energy from one object to another. In science, heat is used only for this second	**6.2 Thermal Energy: Cup Design** Lesson 1, Lesson 4, Lesson 6, Lesson 10, Lesson 11, Lesson 12, Lesson 13, Lesson 14

meaning; it refers to the energy transferred due to the temperature difference between two objects.	
PS3.A: Definitions of Energy • The temperature of a system is proportional to the average internal kinetic energy and potential energy per atom or molecule (whichever is the appropriate building block for the system's material). The details of that relationship depend on the type of atom or molecule and the interactions among the atoms in the material. Temperature is not a direct measure of a system's total thermal energy. The total thermal energy (sometimes called the total internal energy) of a system depends jointly on the temperature, the total number of atoms in the system, and the state of the material.	**6.2 Thermal Energy: Cup Design** Lesson 1, Lesson 4, Lesson 6, Lesson 10, Lesson 11, Lesson 12, Lesson 13, Lesson 14 **6.3 Weather, Climate, and Water Cycling: Storms** Lesson 4, Lesson 5, Lesson 8
PE **MS-PS1-5** Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.	**7.1 Chemical Reactions and Matter: Bath Bombs**
DCI **PS1.B: Chemical Reactions** • Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants.	**7.1 Chemical Reactions and Matter: Bath Bombs** Lesson 1, Lesson 2, Lesson 3, Lesson 4, Lesson 6, Lesson 12
PS1.B: Chemical Reactions • The total number of each type of atom is conserved, and thus the mass does not change.	**7.1 Chemical Reactions and Matter: Bath Bombs** Lesson 2, Lesson 6, Lesson 12
PE **MS-PS1-6** Undertake a design project to construct test and modify a device that either releases or absorbs thermal energy by chemical processes.	**7.2 Chemical Reactions and Energy**
DCI **PS1.B Chemical Reactions** • Some chemical reactions release energy, others store energy.	**7.2 Chemical Reactions and Energy (the content learned in specific lessons is utilized throughout this unit to design the solution)** Lesson 1, Lesson 2, Lesson 3, Lesson 10
ETS1.B: Developing Possible Solutions • A solution needs to be tested, and then modified on the basis of the test results, in order to improve it.	**7.2 Chemical Reactions and Energy** Lesson 1, Lesson 3, Lesson 4, Lesson 5, Lesson 6, Lesson 8, Lesson 9
ETS1.C: Optimizing the Design Solution • Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide	**7.2 Chemical Reactions and Energy** Lesson 1, Lesson 2, Lesson 3, Lesson 4, Lesson 5, Lesson 6, Lesson 7, Lesson 8, Lesson 9, Lesson 10

useful information for the redesign process —that is, some of the characteristics may be incorporated into the new design.	
ETS1.C: Optimizing the Design Solution ● The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution.	**7.2 Chemical Reactions and Energy** Lesson 1, Lesson 3, Lesson 4, Lesson 5, Lesson 6, Lesson 7, Lesson 8, Lesson 9
PE **MS-PS2-1** Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.	**8.1 Contact Forces**
DCI **PS2.A Forces and Motion** ● For any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first, but in the opposite direction (Newton's third law).	**8.1 Contact Forces** Lesson 1, Lesson 2, Lesson 3, Lesson 5, Lesson 6, Lesson 13, Lesson 16
PE **MS-PS2-2 Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.**	**8.1 Contact Forces**
DCI **PS2.A Forces and Motion** ● The motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero, its motion will change. The greater the mass of the object, the greater the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion.	**8.1 Contact Forces** Lesson 1, Lesson 2, Lesson 4, Lesson 5, Lesson 7, Lesson 8, Lesson 9, Lesson 10, Lesson 11, Lesson 13, Lesson 16
PS2.A Forces and Motion ● All positions of objects and the directions of forces and motions must be described in an arbitrarily chosen reference frame and arbitrarily chosen units of size. In order to share information with other people, these choices must also be shared.	**8.1 Contact Forces** Lesson 1, Lesson 2, Lesson 4, Lesson 5, Lesson 7. Lesson 8, Lesson 10, Lesson 13, Lesson 16
PE **MS-PS2-3 Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.**	**8.3 Forces at a Distance**
DCI **PS2.B Types of Interactions** ● Electric and magnetic (electromagnetic) forces can be attractive or repulsive, and their sizes depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects.	**8.3 Forces at a Distance** Lesson 1, Lesson 2, Lesson 5, Lesson 6, Lesson 8, Lesson 9, Lesson 10, Lesson 11, Lesson 12

PE **MS-PS2-4 Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects**	**8.4 Earth in Space**
DCI **PS2.B Types of Interactions** ● Gravitational forces are always attractive. There is a gravitational force between any two masses, but it is very small except when one or both of the objects have large mass—e.g., Earth and the sun.	**8.4 Earth in Space** Lesson 1, Lesson 13, Lesson 14, Lesson 15, Lesson 17
PE **MS-PS2-5 Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.**	**8.3 Forces at a Distance**
DCI **PS2.B Types of Interactions** ● Forces that act at a distance (electric, magnetic, and gravitational) can be explained by fields that extend through space and can be mapped by their effect on a test object (a charged object, or a ball, respectively).	**8.3 Forces at a Distance** Lesson 1, Lesson 2, Lesson 3, Lesson 4, Lesson 5, Lesson 6, Lesson 9, Lesson 10, Lesson 12
PE **MS-PS3-1 Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.**	**8.1 Contact Forces**
DCI **PS3.A Definitions of Energy** ● Motion energy is properly called kinetic energy; it is proportional to the mass of the moving object and grows with the square of its speed.	**8.1 Contact Forces** Lesson 1, Lesson 2, Lesson 3, Lesson 4, Lesson 5, Lesson 7, Lesson 10, Lesson 13, Lesson 16
PE **MS-PS3-2 Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.**	**8.3 Forces at a Distance**

DCI **PS3.A Definitions of Energy** ● A system of objects may also contain stored (potential) energy, depending on their relative positions.	**8.3 Forces at a Distance** Lesson 1, Lesson 7, Lesson 8, Lesson 9, Lesson 10, Lesson 12
PS3.C Relationship Between Energy and Forces ● When two objects interact, each one exerts a force on the other that can cause energy to be transferred to or from the object.	**8.2 Sound Waves** **Lessons about hitting something harder generates more energy**
PE **MS-PS3-3 Apply scientific principles to design, construct, and test a device that either minimizes or maximizes the thermal energy transfer.**	**6.2 Thermal Energy: Cup Design** **6.5 Natural Hazards** **7.5 Ecosystem Dynamics**
DCI **PS3.A Definitions of Energy** ● Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present.	**6.2 Thermal Energy: Cup Design** Lesson 1, Lesson 2, Lesson 9, Lesson 10, Lesson 15, Lesson 16, Lesson 17
PS3.B Conservation of Energy and Energy Transfer ● Energy is spontaneously transferred out of hotter regions or objects and into colder ones.	**6.2 Thermal Energy: Cup Design** Lesson 1, Lesson 2, Lesson 9, Lesson 10, Lesson 15, Lesson 16, Lesson 17
ETS1.A Defining and Delimiting Engineering Problems ● The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that is likely to limit possible solutions.	**6.5 Natural Hazards** Lesson 1, Lesson 5, Lesson 6, Lesson 8, Lesson 9 **7.5 Ecosystem Dynamics** Lesson 6, Lesson 17, Lesson 18, Lesson 19, Lesson 20
PE **MS-PS3-4 Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.**	**6.2 Thermal Energy: Cup Design**
DCI **PS3.A Definitions of Energy** ● Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present.	**6.2 Thermal Energy: Cup Design** Lesson 1, Lesson 2, Lesson 3, Lesson 4, Lesson 7, Lesson 9, Lesson 10, Lesson 11, Lesson 12, Lesson 14, Lesson 15
PS3.B Conservation of Energy and Energy Transfer	**6.2 Thermal Energy: Cup Design**

• The amount of energy transfer needed to change the temperature of a matter sample by a given amount depends on the nature of the matter, the size of the sample, and the environment.	Lesson 1, Lesson 2, Lesson 3, Lesson 4, Lesson 5, Lesson 7, Lesson 9, Lesson 10, Lesson 12, Lesson 14, Lesson 18
PE **MS-PS3-5 Construct, use, and present arguments to support the claim that when the motion energy of an object changes, energy is transferred to or from the object.**	**6.2 Thermal Energy: Cup Design** **8.1 Sound Waves**
DCI **PS3.B Conservation of Energy and Energy Transfer** • When the motion energy of an object changes, there is inevitably some other change in energy at the same time.	**6.2 Thermal Energy: Cup Design** Lesson 4, Lesson 5, Lesson 12, Lesson 13, Lesson 14, Lesson 18 **8.1 Sound Waves** **Lessons about hitting something harder generates more energy**
PE **MS-PS4-1 Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.**	**8.2 Sound Waves**
DCI **PS4.A Wave Properties** • A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude.	**8.2 Sound Waves** Lesson 1, Lesson 2, Lesson 3, Lesson 4, Lesson 5, Lesson 6, Lesson 10, Lesson 11, Lesson 13, Lesson 14
PE **MS-PS4-2 Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.**	**6.1 Light and Matter: One Way Mirror** **6.2 Thermal Energy: Cup Design** **8.4 Earth in Space**
DCI **PS4.A Wave Properties** • A sound wave needs a medium through which it is transmitted.	**8.2 Sound Waves** Lesson 1, Lesson 2, Lesson 3, Lesson 5, Lesson 6, Lesson 7, Lesson 8, Lesson 9, Lesson 10, Lesson 11, Lesson 12, Lesson 14
PS4.B Electromagnetic Radiation • When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency (color) of the light.	**6.1 Light and Matter: One Way Mirror** Lesson 1, Lesson 2, Lesson 3, Lesson 4, Lesson 5, Lesson 6, Lesson 7, Lesson 8 **6.2 Thermal Energy: Cup Design** Lesson 7 Lesson 8, Lesson 15 **8.4 Earth in Space** Lesson 10, Lesson 11
PS4.B Electromagnetic Radiation • The path that light travels can be traced as straight lines, except at surfaces between different transparent materials (e.g., air and water, air and glass) where the light path bends.	**6.1 Light and Matter: One Way Mirror** Lesson 1, Lesson 2, Lesson 3, Lesson 4, Lesson 5, Lesson 6, Lesson 7, Lesson 8 **8.4 Earth in Space** Lesson 10, Lesson 11, Lesson 12

PS4.B Electromagnetic Radiation • A wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media.	**8.4 Earth in Space** Lesson 8, Lesson 9, Lesson 10, Lesson 11, Lesson 12
PS4.B Electromagnetic Radiation • However, because light can travel through space, it cannot be a matter wave, like sound or water waves.	**8.4 Earth in Space** Lesson 8, Lesson 9, Lesson 10, Lesson 11, Lesson 12
PE **MS-PS4-3 Integrate qualitative scientific and technical information to support the claim that digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information.**	**6.5 Natural Hazards**
DCI **PS4.C Information Technologies and Instrumentation** • Digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information.	**6.5 Natural Hazards** Lesson 1, Lesson 6, Lesson 7, Lesson 8
PE **MS-LS1-1 Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.**	**6.6 Cells and Systems: Healing**
DCI **LS1.A: Structure and Function** • All living things are made up of cells, which is the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular).	**6.6 Cells and Systems: Healing** Lesson 1, Lesson 4, Lesson 5, Lesson 6, Lesson 7, Lesson 9, Lesson 10, Lesson 14
PE **MS-LS1-2 Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function.**	**6.6 Cells and Systems: Healing** **7.4 Matter Cycling and Photosynthesis**
DCI **LS1.A: Structure and Function** • Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell.	**6.6 Cells and Systems: Healing** Lesson 1, Lesson 6, Lesson 7, Lesson 8, Lesson 9, Lesson 10, Lesson 11 **7.4 Matter Cycling and Photosynthesis** Lesson 4, Lesson 5, Lesson 6, Lesson 8, Lesson 15
PE **MS-LS1-3 Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.**	**6.6 Cells and Systems: Healing** **7.3 Metabolic Reactions**
DCI **LS1.A: Structure and Function**	**6.6 Cells and Systems: Healing** Lesson 1, Lesson 2, Lesson 3, Lesson 4, Lesson 5, Lesson 6, Lesson 7, Lesson 8, Lesson 9, Lesson 12, Lesson 13, Lesson 14

• In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions.	**7.3 Metabolic Reactions** Lesson 1, Lesson 2, Lesson 4, Lesson 6, Lesson 7, Lesson 8, Lesson 9, Lesson 12, Lesson 13, Lesson 14, Lesson 15
PE **MS-LS1-4 Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.**	**8.5 Genetics** **8.6 Natural Selection and Common Ancestry**
DCI **LS1.B Growth and Development of Organisms** • Animals engage in characteristic behaviors that increase the odds of reproduction.	**8.6 Natural Selection and Common Ancestry** Lesson 1, Lesson 2, Lesson 7, Lesson 11
LS1.B Growth and Development of Organisms • Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction.	**8.5 Genetics** Lesson 13, Lesson 17
PE **MS-LS1-5 Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.**	**7.3 Metabolic Reactions** **8.5 Genetics**
LS1.B Growth and Development of Organisms The growth of an animal is controlled by genetic factors,* food intake,	**7.3 Metabolic Reactions** **Lesson 10,** Lesson 13, Lesson 14, Lesson 15
DCI **LS1.B Growth and Development of Organisms** • Genetic factors as well as local conditions affect the growth of the adult plant.	**8.5 Genetics** Lesson 1, Lesson 3, Lesson 4, Lesson 5, Lesson 6, Lesson 7, Lesson 8, Lesson 9, Lesson 10, Lesson 11, Lesson 12, Lesson 13, Lesson 15, Lesson 15, Lesson 16, Lesson 17
PE **MS-LS1-6 Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.**	**7.4 Matter Cycling and Photosynthesis**
DCI **LS1.C Organization for Matter and Energy in Flow in Organisms** • Plants, algae (including phytoplankton), and many microorganisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases oxygen. These sugars can be used immediately or stored for growth or later use.	**7.4 Matter Cycling and Photosynthesis** Lesson 1, Lesson 2, Lesson 3, Lesson 4, Lesson 5, Lesson 6, Lesson 7, Lesson 8, Lesson 9, Lesson 10, Lesson 11, Lesson 12, Lesson 15

PS3.D Energy in Chemical Processes and Everyday Life • The chemical reaction by which plants produce complex food molecules (sugars) requires an energy input (i.e., from sunlight) to occur. In this reaction, carbon dioxide and water combine to form carbon-based organic molecules and release oxygen.	**7.4 Matter Cycling and Photosynthesis** Lesson 1, Lesson 2, Lesson 3, Lesson 4, Lesson 5, Lesson 6, Lesson 7, Lesson 8, Lesson 9, Lesson 10, Lesson 11, Lesson 12, Lesson 15
PE **MS-LS1-7 Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.**	**7.3 Metabolic Reactions**
DCI **LS1.C Organization for Matter and Energy in Flow in Organisms** • Within individual organisms, food moves through a series of chemical reactions in which it is broken down and rearranged to form new molecules, to support growth, or to release energy.	**7.3 Metabolic Reactions** Lesson 1, Lesson 2, Lesson 4, Lesson 5, Lesson 6, Lesson 7, Lesson 10, Lesson 11, Lesson 12, Lesson 13, Lesson 14, Lesson 15
PS3.D Energy in Chemical Processes and Everyday Life • Cellular respiration in plants and animals involve chemical reactions with oxygen that release stored energy. In these processes, complex molecules containing carbon react with oxygen to produce carbon dioxide and other materials.	**7.3 Metabolic Reactions** Lesson 11, Lesson 12, Lesson 13, Lesson 14, Lesson 15
PE **MS-LS1-8 Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.**	**6.1 Light and Matter: One Way Mirror** **6.6 Cells and Systems: Healing** **7.1 Chemical Reactions and Matter: Bath Bombs** **8.2 Sound Waves**
DCI **LS1.D Information Processing** • Each sense receptor responds to different inputs (electromagnetic, mechanical, chemical), transmitting them as signals that travel along nerve cells to the brain. The signals are then processed in the brain, resulting in immediate behaviors or memories.	**6.1 Light and Matter: One Way Mirror** Lesson 1, Lesson 2, Lesson 6, Lesson 7, Lesson 8 **6.6 Cells and Systems: Healing** Lesson 5 **7.1 Chemical Reactions and Matter: Bath Bombs** Lesson 1, Lesson 13 **8.2 Sound Waves** Lesson 12

PE **MS-LS2-1 Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an environment.**	**7.5 Ecosystem Dynamics**
DCI **LS2.A: Interdependent Relationships in Ecosystems** ● Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors.	**7.5 Ecosystem Dynamics** Lesson 1, Lesson 3, Lesson 6, Lesson 7, Lesson 8, *Lesson 9, Lesson 10, Lesson 11, Lesson 12*
LS2.A: Interdependent Relationships in Ecosystems ● In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction.	**7.5 Ecosystem Dynamics** Lesson 1, Lesson 3, Lesson 6, Lesson 8, Lesson 13
LS2.A: Interdependent Relationships in Ecosystems ● Growth of organisms and population increases are limited by access to resources.	**7.5 Ecosystem Dynamics** Lesson 1, Lesson 7, Lesson 8, Lesson 9, Lesson 10, Lesson 11,
MS-LS2-2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems	**7.5 Ecosystem Dynamics**
LS2.A: Interdependent Relationships in Ecosystems ● Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared.	**7.5 Ecosystem Dynamics** Lesson 1, Lesson 11, Lesson 12, Lesson 13
PE **MS-LS2-3 Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.**	**7.4 Matter Cycling and Photosynthesis**
DCI **LS2.B Cycle of Matter and Energy Transfer in Ecosystems** ● Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic	**7.4 Matter Cycling and Photosynthesis** Lesson 12, Lesson 13, Lesson 14, Lesson 15

environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem.	
PE **MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.**	**7.5 Ecosystem Dynamics**
DCI **LS2.C Ecosystems Dynamics, Functioning and Resilience** ● Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations.	**7.5 Ecosystem Dynamics** Lesson 1, Lesson 6, Lesson 13, Lesson 15, Lesson 16
PE **MS-LS2-5 Evaluate competing design solutions for maintaining biodiversity and ecosystem services.**	**7.5 Ecosystem Dynamics**
DCI **LS2.C Ecosystem Dynamics, Functioning, and Resilience** ● Biodiversity describes the variety of species found in Earth's terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health.	**7.5 Ecosystem Dynamics** Lesson 1, Lesson 6, Lesson 13, Lesson 14
LS4.D Biodiversity and Humans ● Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on— for example, water purification and recycling.	**7.5 Ecosystem Dynamics** Lesson 1, Lesson 6, Lesson 15, Lesson 16
ETS1.B ● There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem.	
PE **MS-LS3-1 Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.**	**8.5 Genetics**
DCI **LS3.A Inheritance of Traits** ● Genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes. Each distinct gene chiefly controls the production of specific proteins, which in turn affects the traits of the	**8.5 Genetics** Lesson 5, Lesson 6, Lesson 7, Lesson 8, Lesson 13, Lesson 16

individual. Changes (mutations) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits	
LS3.B Variation of Traits • In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations. Though rare, mutations may result in changes to the structure and function of proteins. Some changes are beneficial, others harmful, and some neutral to the organism.	**8.5 Genetics** Lesson 8, Lesson 9, Lesson 16
PE **MS-LS3-2 Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.**	**8.5 Genetics**
DCI **LS1.B Growth and Development of Organisms** • Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring.	**8.5 Genetics** Lesson 1, Lesson 5, Lesson 13, Lesson 14
LS3.A Inheritance of Traits • Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited	**8.5 Genetics** Lesson 1, Lesson 2, Lesson 5, Lesson 6, Lesson 14
LS3.B Variation of Traits • In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals have two of each chromosome and hence two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other.	**8.5 Genetics** Lesson 1, Lesson 2, Lesson 5, Lesson 6, Lesson 8, Lesson 10, Lesson 13, Lesson 16
PE **MS-LS4-1 Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.**	**8.6 Natural Selection and Common Ancestry**
DCI **LS4.A Evidence of Common Ancestry and Diversity** • The collection of fossils and their placement in chronological order (e.g., through the location of the sedimentary layers in which they are found or through radioactive dating) is known as the fossil record. It documents the existence, diversity, extinction, and change of many life forms throughout the history of life on Earth.	**8.6 Natural Selection and Common Ancestry** Lesson 1, Lesson 2, Lesson 3, Lesson 5, Lesson 6, Lesson 12, Lesson 13, Lesson 14

PE **MS-LS4-2 Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.**	**8.6 Natural Selection and Common Ancestry**
DCI **LS4.A Evidence of Common Ancestry and Diversity** ● Anatomical similarities and differences between various organisms living today and between them and organisms in the fossil record, enable the reconstruction of evolutionary history and the inference of lines of evolutionary descent.	**8.6 Natural Selection and Common Ancestry** Lesson 1, Lesson 2, Lesson 3, Lesson 5, Lesson 6, Lesson 12, Lesson 13, Lesson 14
PE **MS-LS4-3 Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy**.	**8.6 Natural Selection and Common Ancestry**
DCI **LS4.A Evidence of Common Ancestry and Diversity** ● Comparison of the embryological development of different species also reveals similarities that show relationships not evident in the fully-formed anatomy.	**8.6 Natural Selection and Common Ancestry** Lesson 1, Lesson 3, Lesson 5, Lesson 6, Lesson 12, Lesson 13, Lesson 14
PE **MS-LS4-4 Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.**	**8.6 Natural Selection and Common Ancestry**
DCI **LS4.B Natural Selection** ● Natural selection leads to the predominance of certain traits in a population, and the suppression of others.	**8.6 Natural Selection and Common Ancestry** Lesson 1, Lesson 7, Lesson 8, Lesson 9, Lesson 10, Lesson 11, Lesson 12, Lesson 13, Lesson 14, Lesson 15
PE **MS-LS4-5 Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms.**	**8.5 Genetics**
DCI **LS4.B Natural Selection** ● In artificial selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed onto offspring.	**8.5 Genetics** Lesson 9, Lesson 13

PE **MS-LS4-6 Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.**	**8.6 Natural Selection and Common Ancestry**
DCI **LS4.C Adaptation** ● Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes.	**8.6 Natural Selection and Common Ancestry** Lesson 1, Lesson 7, Lesson 8, Lesson 9, Lesson 10, Lesson 11, Lesson 12, Lesson 13, Lesson 14, Lesson 15
PE **MS-ESS1-1 Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.**	**8.4 Earth in Space**
DCI **ESS1.A The Universe and Its Stars** ● Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models.	**8.4 Earth in Space** Lesson 1, Lesson 2, Lesson 3, Lesson 4, Lesson 5, Lesson 6, Lesson 17
ESS1:B Earth and the Solar System ● This model of the solar system can explain eclipses of the sun and the moon. Earth's spin axis is fixed in direction over the short-term but tilted relative to its orbit around the sun. The seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year.	**8.4 Earth in Space** Lesson 1, Lesson 2, Lesson 3, Lesson 4, Lesson 5, Lesson 7, Lesson 8, Lesson 12, Lesson 17
PE **MS-ESS1-2 Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.**	**8.4 Earth in Space**
DCI **ESS1.A The Universe and Its Stars** ● Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe.	**8.4 Earth in Space** Lesson 1, Lesson 13, Lesson 16, Lesson 17
ESS1.A The Universe and Its Stars ● The solar system appears to have formed from a disk of dust and gas, drawn together by gravity.	**8.4 Earth in Space** Lesson 1, Lesson 13, Lesson 14, Lesson 15, Lesson 17

ESS1B: Earth and the Solar System ● The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them.	**8.4 Earth in Space** Lesson 1, Lesson 13, Lesson 14, Lesson 15, Lesson 16, Lesson 17
PE **MS-ESS1-3 Analyze and interpret data to determine scale properties of objects in the solar system.**	**8.4 Earth in Space**
DCI **ESS1.B: Earth and the Solar System** ● The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them.	**8.4 Earth in Space** Lesson 1, Lesson 13, Lesson 14, Lesson 15, Lesson 17
PE **MS-ESS1-4 Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.**	**6.4 Plate Tectonics and Rock Cycling**
DCI **ESS1.C: The History of Planet Earth** ● The geologic time scale interpreted from rock strata provides a way to organize Earth's history. Analyses of rock strata and the fossil record provide only relative dates, not an absolute scale.	**6.4 Plate Tectonics and Rock Cycling** Lesson 10, Lesson 11, Lesson 13, Lesson 14
PE **MS-ESS2-1 Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.**	**6.4 Plate Tectonics and Rock Cycling**
DCI **ESS2.A: Earth's Materials and Systems** ● All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the sun and Earth's hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms.	**6.4 Plate Tectonics and Rock Cycling** Lesson 1, Lesson 2, Lesson 3, Lesson 4, Lesson 5, Lesson 6, Lesson 7, Lesson 8, Lesson 9, Lesson 12, Lesson 13, Lesson 14
PE **MS-ESS2-2 Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and special scales.**	**6.4 Plate Tectonics and Rock Cycling**
DCI **ESS2.A: Earth's Materials and Systems**	**6.4 Plate Tectonics and Rock Cycling** Lesson 1, Lesson 2, Lesson 5, Lesson 6, Lesson 7, Lesson 8, Lesson 9, Lesson 10, Lesson 11, Lesson 12, Lesson 13, Lesson 14

• The planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and will determine its future.	
ESS2.C: The Roles of Water in Earth's Surface Processes • Water's movements—both on the land and underground—cause weathering and erosion, which change the land's surface features and create underground formations.	**6.4 Plate Tectonics and Rock Cycling** Lesson 3, Lesson 4, Lesson 5, Lesson 6, Lesson 7, Lesson 8, Lesson 12, Lesson 13, Lesson 14
PE **MS-ESS2-3 Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.**	**6.4 Plate Tectonics and Rock Cycling**
DCI **ESS2.B: Plate Tectonics and Large-Scale System Interactions** • Maps of ancient land and water patterns, based on investigations of rocks and fossils, make clear how Earth's plates have moved great distances, collided, and spread apart.	**6.4 Plate Tectonics and Rock Cycling** Lesson 3, Lesson 4, Lesson 5, Lesson 6, Lesson 7, Lesson 10, Lesson 11, Lesson 14
ESS1.C: The History of Planet Earth • Tectonic processes continually generate new ocean sea floor at ridges and destroy old seafloor at trenches.	**6.4 Plate Tectonics and Rock Cycling** Lesson 4, Lesson 5, Lesson 6, Lesson 7, Lesson 8, Lesson 11, Lesson 14
PE **MS-ESS2-4 Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.**	**6.3 Weather, Climate, and Water Cycling: Storms**
DCI **ESS2.C: The Roles of Water in Earth's Surface Processes** • Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land.	**6.3 Weather, Climate, and Water Cycling: Storms** Lesson 1, Lesson 7, Lesson 8, Lesson 9, Lesson 15, Lesson 16
ESS2.C: The Roles of Water in Earth's Surface Processes • Global movements of water and its changes in form are propelled by sunlight and gravity.	**6.3 Weather, Climate, and Water Cycling: Storms** Lesson 1, Lesson 7, Lesson 8, Lesson 9, Lesson 11, Lesson 13, Lesson 15, Lesson 16, Lesson 19, Lesson 21
PE **MS-ESS2-5 Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.**	**6.3 Weather, Climate, and Water Cycling: Storms**

DCI **ESS2.C: The Roles of Water in Earth's Surface Processes** ● The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns.	**6.3 Weather, Climate, and Water Cycling: Storms** Lesson 1, Lesson 2, Lesson 3, Lesson 4, Lesson 5, Lesson 9, Lesson 10 Lesson 11, Lesson 12, Lesson 13, Lesson 14, Lesson 15, Lesson 16, Lesson 17m, Lesson 18, Lesson 19, Lesson 20, Lesson 21
ESS2.D: Weather and Climate ● Because these patterns are so complex, weather can only be predicted probabilistically.	**6.3 Weather, Climate, and Water Cycling: Storms** Lesson 1, Lesson 2, Lesson 3, Lesson 4, Lesson 5, Lesson 10, Lesson 11, Lesson 12, Lesson 13, Lesson 14, Lesson 15, Lesson 16, Lesson 17, Lesson 18, Lesson 19, Lesson 20, Lesson 21
PE **MS-ESS2-6 Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.**	**6.3 Weather, Climate, and Water Cycling: Storms**
DCI **ESS2.C: The Roles of Water in Earth's Surface Processes** ● Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents.	**6.3 Weather, Climate, and Water Cycling: Storms** Lesson 1, Lesson 12, Lesson 19, Lesson 20, Lesson 21, Lesson 22
ESS2.C: The Roles of Water in Earth's Surface Processes ● Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns.	**6.3 Weather, Climate, and Water Cycling: Storms** Lesson 1, Lesson 4, Lesson 6, Lesson 7, Lesson 8, Lesson 9, Lesson 10, Lesson 11, Lesson 12, Lesson 13, Lesson 14, Lesson 15, Lesson 16, Lesson 17, Lesson 18, Lesson 19, Lesson 20, Lesson 21, Lesson 22
ESS2.D: Weather and Climate ● The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents.	**6.3 Weather, Climate, and Water Cycling: Storms** Lesson 1, Lesson 12, Lesson 19, Lesson 20, Lesson 21, Lesson 22
PE **MS-ESS3-1 Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.**	**7.6 Earth's Resources and Human Impact**
DCI **ESS3.A: Natural Resources** ● Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These	**7.6 Earth's Resources and Human Impact** Lesson 1, Lesson 2, Lesson 3, Lesson 4, Lesson 5, Lesson 6, Lesson 7, Lesson 9, Lesson 18

resources are distributed unevenly around the planet as a result of past geologic processes.	
PE **MS-ESS3-2 Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.**	**6.5 Natural Hazards**
DCI **ESS3.B: Natural Hazards** ● Mapping the history of natural hazards in a region, combined with an understanding of related geologic forces can help forecast the locations and likelihoods of future events.	**6.5 Natural Hazards** Lesson 1, Lesson 2, Lesson 3, Lesson 4, Lesson 5, Lesson 6, Lesson 9, Lesson 10
PE **MS-ESS3-3 Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.**	**7.5 Ecosystem Dynamics** **7.6 Earth's Resources and Human Impact**
DCI **ESS3.C: Human Impacts on Earth Systems** ● Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things.	**7.5 Ecosystem Dynamics** Lesson 1, Lesson 2, Lesson 3, Lesson 4, Lesson 5, Lesson 6, Lesson 14, Lesson 17, Lesson 18, Lesson 19, Lesson 20 **7.6 Earth's Resources and Human Impact** Lesson 1, Lesson 7, Lesson 8, Lesson 9, Lesson 10, Lesson 11, Lesson 12, Lesson 13, Lesson 18
PE **MS-ESS3-4 Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.**	**7.6 Earth's Resources and Human Impact**
DCI **ESS3.C: Human Impacts on Earth Systems** ● Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.	**7.6 Earth's Resources and Human Impact** Lesson 1, Lesson 8, Lesson 10, Lesson 11, Lesson 12, Lesson 13, Lesson 14, Lesson 16, Lesson 18
PE **MS-ESS3-5 Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.**	**7.6 Earth's Resources and Human Impact**

DCI **ESS3.D: Global Climate Change** ● Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth's mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities.	**7.6 Earth's Resources and Human Impact** Lesson 1, Lesson 7, Lesson 8, Lesson 10, Lesson 11, Lesson 12, Lesson 13, Lesson 14, Lesson 15, Lesson 16, Lesson 17, Lesson 18
PE **MS-ETS1-1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.**	**6.5 Natural Hazards** **7.5 Ecosystem Dynamics**
DCI **ETS1.A Defining and Delimiting Engineering Problems** ● The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes **consideration of scientific principles and other relevant knowledge** that are likely to limit possible solutions. (MS-PS3-3)	**6.5 Natural Hazards** Lesson 1, Lesson 5, Lesson 6, Lesson 8, Lesson 9 **7.5 Ecosystem Dynamics** Lesson 6, Lesson 17, Lesson 18, Lesson 19, Lesson 20
PE **MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.**	**6.5 Natural Hazards** **7.2 Chemical Reactions and Energy** **7.6 Earth's Resources and Human Impact** **8.1 Contact Forces**
DCI **ETS1-B. Developing Possible Solutions** ● There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-EST1-3, MS-LS2-5)	**6.5 Natural Hazards** Lesson 1, Lesson 5, Lesson 6, Lesson 7, Lesson 8, Lesson 9 **7.2 Chemical Reactions and Energy** Lesson 1, Lesson 2, Lesson 3, Lesson 4, Lesson 5, Lesson 6, Lesson 8, Lesson 9, Lesson 10 **7.6 Earth's Resources and Human Impact** Lesson 13, Lesson 14, Lesson 15, Lesson 16, Lesson 17, Lesson 18 **8.1 Contact Forces** Lesson 1, Lesson 11, Lesson 12, Lesson 13, Lesson 14, Lesson 15, Lesson 16

PE **MS-ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.**	**7.2 Chemical Reactions and Energy** **8.1 Contact Forces**
DCI **ETS1.B: Developing Possible Solutions** ● There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-ESTS1-2, MS-LS2-5)	**7.2 Chemical Reactions and Energy** Lesson 1, Lesson 2, Lesson 3, Lesson 4, Lesson 5, Lesson 6, Lesson 7, Lesson 8, Lesson 9, Lesson 10 **8.1 Contact Forces** Lesson 1, Lesson 11, Lesson 12, Lesson 13, Lesson 14, Lesson 15, Lesson 16
ETS1.B: Developing Possible Solutions ● Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors.	**7.2 Chemical Reactions and Energy** Lesson 1, Lesson 3, Lesson 4, Lesson 5, Lesson 6, Lesson 8, Lesson 9, Lesson 10 **8.1 Contact Forces** Lesson 1, Lesson 11, Lesson 12, Lesson 13, Lesson 14, Lesson 15, Lesson 16
ETS1.C: Optimizing the Design Solution ● Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of those characteristics may be incorporated into the new design.	**7.2 Chemical Reactions and Energy** Lesson 1, Lesson 2, Lesson 3, Lesson 4, Lesson 5\, Lesson 6, Lesson 7, Lesson 8, Lesson 9, Lesson 10 **8.1 Contact Forces** Lesson 1, Lesson 11, Lesson 12, Lesson 13, Lesson 14, Lesson 15, Lesson 16
PE **MS-ETS1-4 Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.**	**6.2 Thermal Energy: Cup Design** **7.2 Chemical Reactions and Energy**
DCI **ETS1.B: Developing Possible Solutions** ● A solution needs to be tested, and then modified on the basis of the test results in order to improve it. (MS-PS1-6, MS-PS3-3)	**6.2 Thermal Energy: Cup Design** Lesson 2, Lesson 3, Lesson 15, Lesson 16, Lesson 17 **7.2 Chemical Reactions and Energy** Lesson 1, Lesson 3, Lesson 4, Lesson 5, Lesson 6, Lesson 7, Lesson 8, Lesson 9
ETS1.B: Developing Possible Solutions ● Models of all kinds are important for testing solutions.	**6.2 Thermal Energy: Cup Design** Lesson 2, Lesson 3, Lesson 15, Lesson 16, Lesson 17 **7.2 Chemical Reactions and Energy** Lesson 1, Lesson 3, Lesson 6, Lesson 9
ETS1.C: Optimizing the Design Solution ● The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. (MS-PS1-6)	**6.2 Thermal Energy: Cup Design** Lesson 2, Lesson 3, Lesson 15, Lesson 16, Lesson 17 **7.2 Chemical Reactions and Energy** Lesson 1, Lesson 3, Lesson 4, Lesson 5, Lesson 6, Lesson 7, Lesson 8, Lesson 9