MS-PS1-4 Matter and Its Interactions

Science & Engineering Practices	Disciplinary Core Ideas	Performance Expectations
❶ Asking questions (for science) and defining problems (for engineering) ❷ **Developing and using models Modeling in 6–8 builds on K–5 and progresses to developing, using and revising models to describe, test, and predict more abstract phenomena and design systems.** **• Develop a model to predict and/or describe phenomena.** ❸ Planning and carrying out investigations ❹ Analyzing and interpreting data ❺ Using mathematics and computational thinking ⊙ Constructing explanations (for science) and designing solutions (for engineering) ❼ Engaging in argument from evidence ❽ Obtaining, evaluating, and communicating information	**Structure and Properties of Matter:** • Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. 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. • The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter. **Definitions of Energy:** (secondary to MS-PS1-4) • 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 meaning; it refers to the energy transferred due to the temperature difference between two objects. • 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.	**MS-PS1-4** *Students who demonstrate understanding can:* **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.** **Clarification Statement:** Emphasis is on qualitative molecular-level models of solids, liquids, and gases to show that adding or removing thermal energy increases or decreases kinetic energy of the particles until a change of state occurs. Examples of models could include drawings and diagrams. Examples of particles could include molecules or inert atoms. Examples of pure substances could include water, carbon dioxide, and helium. **Assessment Boundary:** The use of mathematical formulas is not intended.

Crosscutting Concepts: Cause and Effect
- Cause and effect relationships may be used to predict phenomena in natural or designed systems.

6–8

Oklahoma Academic Standards Connections

ELA/Literacy	Mathematics

Resources
- Gases & Liquids—Atoms Family
- Changes of State—flipbook showing particle motion changes; Bubbling Up investigation
- Mass/Volume/Length labs
- Pearson Interactive Science--Chapter 1. Do p.458 first

Academic Vocabulary
Atoms, molecules, protons, neutrons, electrons

MS-PS2-3 Motion and Stability: Forces and Interactions

Science & Engineering Practices	Disciplinary Core Ideas	Performance Expectations
❶ **Asking questions (for science) and defining problems (for engineering) Asking questions and defining problems in grades 6–8 builds from grades K–5 experiences and progresses to specifying relationships between variables, and clarifying arguments and models.** • **Ask questions that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles.** ❷ Developing and using models ❸ Planning and carrying out investigations ❹ Analyzing and interpreting data ❺ Using mathematics and computational thinking ⊙ Constructing explanations (for science) and designing solutions (for engineering) ❼ Engaging in argument from evidence ❽ Obtaining, evaluating, and communicating information	**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.	**MS-PS2-3** *Students who demonstrate understanding can:* **Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.** **Clarification Statement:** Examples of devices that use electric and magnetic forces could include electromagnets, electric motors, or generators. Examples of data could include the effect of the number of turns of wire on the strength of an electromagnet, or the effect of increasing the number or strength of magnets on the speed of an electric motor. **Assessment Boundary:** Assessment about questions that require quantitative answers is limited to proportional reasoning and algebraic thinking. Assessment of Coulomb's Law is not intended.

Crosscutting Concepts: Cause and Effect
• Cause and effect relationships may be used to predict phenomena in natural or designed systems.

Oklahoma Academic Standards Connections

ELA/Literacy	Mathematics

Connection to PASS Coming Soon

Resources
- Pearson Interactive Science-- Chapter 3: Electrical Magnetism. Lessons 1, 2, and 5

Academic Vocabulary

6-8

MS-PS2-5 Motion and Stability: Forces and Interactions

Science & Engineering Practices	Disciplinary Core Ideas	Performance Expectations
❶ Asking questions (for science) and defining problems (for engineering) ❷ Developing and using models ❸ **Planning and carrying out investigations** **Planning and carrying out investigations to answer questions or test solutions to problems in 6–8 builds on K–5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or design solutions.** • **Conduct an investigation and evaluate the experimental design to produce data to serve as the basis for evidence that can meet the goals of the investigation.** ❹ Analyzing and interpreting data ❺ Using mathematics and computational thinking ⦿ Constructing explanations (for science) and designing solutions (for engineering) ❼ Engaging in argument from evidence ❽ Obtaining, evaluating, and communicating information	**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).	**MS-PS2-5** *Students who demonstrate understanding can:* **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.** **Clarification Statement:** Examples of this phenomenon could include the interactions of magnets, electrically-charged strips of tape, and electrically-charged pith balls. Examples of investigations could include first-hand experiences or simulations. **Assessment Boundary:** Assessment is limited to electric and magnetic fields, and limited to qualitative evidence for the existence of fields.

Crosscutting Concepts: Cause and Effect
- Cause and effect relationships may be used to predict phenomena in natural or designed systems.

Oklahoma Academic Standards Connections

ELA/Literacy	Mathematics
Connection to PASS Coming Soon	

Resources
- Magnet & Electricity review
- Electro magnets
- Simple motor
    - Pearson Interactive Science--Chapter 3: Electrical Magnetism. Lessons 2, 3, and 4

Academic Vocabulary
Electromagnetic spectrum

MS-PS3-1 Energy

Science & Engineering Practices	Disciplinary Core Ideas	Performance Expectations
❶ Asking questions (for science) and defining problems (for engineering) ❷ Developing and using models ❸ Planning and carrying out investigations ❹ **Analyzing and interpreting data** **Analyzing data in 6–8 builds on K–5 and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.** • **Construct and interpret graphical displays of data to identify linear and nonlinear relationships.** ❺ Using mathematics and computational thinking ⊙ Constructing explanations (for science) and designing solutions (for engineering) ❼ Engaging in argument from evidence ❽ Obtaining, evaluating, and communicating information	**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.	**MS-PS3-1** *Students who demonstrate understanding can:* **Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.** **Clarification Statement:** Emphasis is on descriptive relationships between kinetic energy and mass separately from kinetic energy and speed. Examples could include riding a bicycle at different speeds, rolling different sizes of rocks downhill, and getting hit by a wiffle ball versus a tennis ball. **Assessment Boundary:** Does not include mathematical calculations of kinetic energy.

Crosscutting Concepts: Scale, Proportion, and Quantity

- Proportional relationships (e.g. speed as the ratio of distance traveled to time taken) among different types of quantities provide information about the magnitude of properties and processes.

Oklahoma Academic Standards Connections

ELA/Literacy	Mathematics

Connection to PASS Coming Soon

Resources

- Why basketballs bounce and eggs do not
- Cars/Marbles down a ramp
- Roller coaster (PhET.colorado.edu)
- Pearson Interactive Science--Chapter 2

Academic Vocabulary

Kinetic energy
Potential energy

MS-PS3-2 Energy

Science & Engineering Practices	Disciplinary Core Ideas	Performance Expectations
❶ Asking questions (for science) and defining problems (for engineering) ❷ **Developing and using models** **Modeling in 6–8 builds on K–5 and progresses to developing, using and revising models to describe, test, and predict more abstract phenomena and design systems.** • **Develop a model to predict and/or describe phenomena.** ❸ Planning and carrying out investigations ❹ Analyzing and interpreting data ❺ Using mathematics and computational thinking ⊙ Constructing explanations (for science) and designing solutions (for engineering) ❼ Engaging in argument from evidence ❽ Obtaining, evaluating, and communicating information	**Definitions of Energy:** • A system of objects may also contain stored (potential) energy, depending on their relative positions. **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.	**MS-PS3-2** *Students who demonstrate understanding can:* **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.** **Clarification Statement:** Emphasis is on relative amounts of potential energy, not on calculations of potential energy. Examples of objects within systems interacting at varying distances could include: the Earth and either a roller coaster cart at varying positions on a hill or objects at varying heights on shelves, changing the direction/orientation of a magnet, and a balloon with static electrical charge being brought closer to a classmate's hair. Examples of models could include representations, diagrams, pictures, and written descriptions of systems. **Assessment Boundary:** Assessment is limited to two objects and electric, magnetic, and gravitational interactions.

Crosscutting Concepts: Systems and System Models

- Models can be used to represent systems and their interactions – such as inputs, processes, and outputs – and energy and matter flows within systems.

Oklahoma Academic Standards Connections

ELA/Literacy	Mathematics

Connection to PASS Coming Soon

Resources

- Egg drop
- Newton's Cradle
- Perpetual Motion
- Flip book of Induced Charge
- Static Electric investigation
- Pearson Interactive Science--Chapter 3: Electrical Magnetism. Lesson 3

Academic Vocabulary

Potential energy, static electricity, induced charge, energy transformation, energy conservation

MS-PS3-3 Energy

Science & Engineering Practices	Disciplinary Core Ideas	Performance Expectations
❶ Asking questions (for science) and defining problems (for engineering) ❷ Developing and using models ❸ Planning and carrying out investigations ❹ Analyzing and interpreting data ❺ Using mathematics and computational thinking ⊙ **Constructing explanations (for science) and designing solutions (for engineering)** **Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.** • **Apply scientific ideas or principles to design, construct, and test a design of an object, tool, process or system.** ❼ Engaging in argument from evidence ❽ Obtaining, evaluating, and communicating information	**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. **Conservation of Energy and Energy Transfer:** • Energy is spontaneously transferred out of hotter regions or objects and into colder ones. **Defining and Delimiting an Engineering Problem:** (secondary to MS-PS3-3) • 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. **Developing Possible Solutions:** (secondary to MS-PS3-3) • A solution needs to be tested, and then modified on the basis of the test results in order to improve it. • There are systematic processes for evaluating solutions with respect to how well they meet criteria and constraints of a problem.	**MS-PS3-3** *Students who demonstrate understanding can:* **<u>Apply scientific principles to design, construct, and test</u> a device that either minimizes or maximizes thermal energy transfer.*** **Clarification Statement:** Examples of devices could include an insulated box, a solar cooker, and a Styrofoam cup. Care should be taken with devices that concentrate significant amounts of energy, e.g. conduction, convection, and/or radiation. **Assessment Boundary:** Assessment does not include calculating the total amount of thermal energy transferred.

Crosscutting Concepts: Energy and Matter

• The transfer of energy can be tracked as energy flows through a designed or natural system.

Oklahoma Academic Standards Connections

ELA/Literacy	Mathematics

Connection to PASS Coming Soon

Resources

- Insulated box
- Build efficient solar cooker
- Pearson Interactive Science--Chapter 1: Gas Behavior. Lesson 3
- (need project)

Academic Vocabulary

Conductor, insulator, independent variable, control variable, thermal energy, conduction, convection, radiation, Law of Conservation, gas behavior

6-8

MS-PS3-4 Energy

Science & Engineering Practices	Disciplinary Core Ideas	Performance Expectations
❶ Asking questions (for science) and defining problems (for engineering) ❷ Developing and using models ❸ **Planning and carrying out investigations** **Planning and carrying out investigations to answer questions or test solutions to problems in 6–8 builds on K–5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or design solutions.** • **Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim.** ❹ Analyzing and interpreting data ❺ Using mathematics and computational thinking ⊙ Constructing explanations (for science) and designing solutions (for engineering) ❼ Engaging in argument from evidence ❽ Obtaining, evaluating, and communicating information	**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. **Conservation of Energy and Energy Transfer:** • 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.	**MS-PS3-4** *Students who demonstrate understanding can:* **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.** **Clarification Statement:** Examples of experiments could include comparing final water temperatures after different masses of ice melted in the same volume of water with the same initial temperature, the temperature change of samples of different materials with the same mass as they cool or heat in the environment, or the same material with different masses when a specific amount of energy is added. **Assessment Boundary:** Assessment does not include calculating the total amount of thermal energy transferred.

6-8

Crosscutting Concepts: Scale, Proportion, and Quantity

- Proportional relationships (e.g. speed as the ratio of distance traveled to time taken) among different types of quantities provide information about the magnitude of properties and processes.

Oklahoma Academic Standards Connections

ELA/Literacy	Mathematics

Connection to PASS Coming Soon

Resources

- Improve the investigation from 3-3—changing the independent variables—the amount of matter or the states of matter
- Pearson Interactive Science--Chapter 1: Gas Behavior. Lesson 3
- (need project)

Academic Vocabulary

kinetic energy, potential energy, static electricity, induced charge, gas behavior

MS-LS1-1 From Molecules to Organisms: Structure and Processes

Science & Engineering Practices	Disciplinary Core Ideas	Performance Expectations
❶ Asking questions (for science) and defining problems (for engineering) ❷ Developing and using models **❸ Planning and carrying out investigations** **Planning and carrying out investigations in 6-8 builds on K- 5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or solutions.** **• Conduct an investigation to produce data to serve as the basis for evidence that meet the goals of an investigation.** ❹ Analyzing and interpreting data ❺ Using mathematics and computational thinking ⦿ Constructing explanations (for science) and designing solutions (for engineering) ❼ Engaging in argument from evidence ❽ Obtaining, evaluating, and communicating information	**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).	**MS-LS1-1** *Students who demonstrate understanding can:* **Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.** **Clarification Statement:** Emphasis is on developing evidence that living things are made of cells, distinguishing between living and non-living cells, and understanding that living things may be made of one cell or many and varied cells. **Assessment Boundary:** Assessments should provide evidence of students' abilities to identify evidence that living things are made of cells and distinguish between living and nonliving cells.

Crosscutting Concepts: Scale, Proportion, and Quantity

• Phenomena that can be observed at one scale may not be observable at another scale.

Oklahoma Academic Standards Connections

ELA/Literacy	Mathematics

Connection to PASS Coming Soon

Resources

- Look at a variety of cells (body system cells)
- Microscope tools
- Small e Lab
- Pearson Interactive Science--Chapter 5: Discovering Cells

Academic Vocabulary

Technology, micro

6-8

MS-LS1-2 From Molecules to Organisms: Structure and Processes

Science & Engineering Practices	Disciplinary Core Ideas	Performance Expectations
❶ Asking questions (for science) and defining problems (for engineering) ❷ **Developing and using models Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.** • **Develop and use a model to describe phenomena.** ❸ Planning and carrying out investigations ❹ Analyzing and interpreting data ❺ Using mathematics and computational thinking ⊙ Constructing explanations (for science) and designing solutions (for engineering) ❼ Engaging in argument from evidence ❽ Obtaining, evaluating, and communicating information	**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.	**MS-LS1-2** *Students who demonstrate understanding can:* **Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function.** **Clarification Statement:** Emphasis is on the cell functioning as a whole system and the primary role of identified parts of the cell, specifically the nucleus, chloroplasts, mitochondria, cell membrane, and cell wall. Other organelles should be introduced while covering this concept. **Assessment Boundary:** Assessment of organelle structure/function relationships is limited to the cell wall and cell membrane. Assessment of the function of the other organelles is limited to their relationship to the whole cell. Assessment does not include the biochemical function of cells or cell parts.

Crosscutting Concepts: Structure and Function

- Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the relationships among its parts, therefore complex natural structures/systems can be analyzed to determine how they function.

Oklahoma Academic Standards Connections

ELA/Literacy	Mathematics

Connection to PASS Coming Soon

Resources

- Cell City
- Pearson Interactive Science--Chapter 5. Lesson 2: Looking Inside Cells

Academic Vocabulary

Organelles, nucleus, chloroplasts, mitochondria, cell membrane, cell wall

MS-LS1-3 From Molecules to Organisms: Structure and Processes

Science & Engineering Practices	Disciplinary Core Ideas	Performance Expectations
❶ Asking questions (for science) and defining problems (for engineering) ❷ Developing and using models ❸ Planning and carrying out investigations ❹ Analyzing and interpreting data ❺ Using mathematics and computational thinking ⊙ Constructing explanations (for science) and designing solutions (for engineering) ❼ **Engaging in argument from evidence** **Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s).** • **Use an oral and written argument supported by evidence to support or refute an explanation or a model for a phenomenon.** ❽ Obtaining, evaluating, and communicating information	**Structure and Function:** • 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.	**MS-LS1-3** *Students who demonstrate understanding can:* **Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.** **Clarification Statement:** Emphasis is on the conceptual understanding that cells form tissues and tissues form organs specialized for particular body functions. Examples could include the interaction of subsystems within a system and the normal functioning of those systems. **Assessment Boundary:** Assessment does not include the mechanism of one body system independent of others. Assessment is limited to the circulatory, excretory, digestive, respiratory, muscular, and nervous systems.

Crosscutting Concepts: Systems and System Models
• Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems.

Oklahoma Academic Standards Connections

ELA/Literacy	Mathematics

Connection to PASS Coming Soon

Resources
- Research/opinion essay on effects of body systems
- How the shape of the cell is determined by function
- Pearson Interactive Science—Chapter 7: Introduction to the Human Body

Academic Vocabulary
Circulatory, excretory, digestive, respiratory, muscular, nervous system, tissues, organs, organ system

MS-LS1-6 From Molecules to Organisms: Structure and Processes

Science & Engineering Practices	Disciplinary Core Ideas	Performance Expectations
❶ Asking questions (for science) and defining problems (for engineering) ❷ Developing and using models ❸ Planning and carrying out investigations ❹ Analyzing and interpreting data ❺ Using mathematics and computational thinking ⦿ **Constructing explanations (for science) and designing solutions (for engineering)** **Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific knowledge, principles, and theories.** • **Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) 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.** ❼ Engaging in argument from evidence ❽ Obtaining, evaluating, and communicating information	**Organization for Matter and Energy 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. **Energy in Chemical Processes and Everyday Life:** (secondary to MS-LS1-6): • 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.	**MS-LS1-6** *Students who demonstrate understanding can:* **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.** **Clarification Statement:** Emphasis is on tracing movement of matter and flow of energy. **Assessment Boundary:** Assessment does not include the biochemical mechanisms of photosynthesis.

Crosscutting Concepts: Energy and Matter

- Within a natural system, the transfer of energy drives the motion and/or cycling of matter.

Oklahoma Academic Standards Connections

ELA/Literacy	Mathematics

Connection to PASS Coming Soon

Resources

- Carbon dioxide cycle
- Nitrogen cycle
- Transpiration
- Pearson Interactive Science—Chapter 6. Lesson 1: Photosynthesis

Academic Vocabulary

Photosynthesis, carbon dioxide, Law of Conservation, transpiration, respiration

6-8

MS-LS2-1 Ecosystems: Interactions, Energy, and Dynamics

Science & Engineering Practices

1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. **Analyzing and interpreting data**
   Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.
   - **Analyze and interpret data to provide evidence for phenomena.**
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

Disciplinary Core Ideas

Interdependent Relationships in Ecosystems:

- Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors.
- 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.
- Growth of organisms and population increases are limited by access to resources.

Performance Expectations

MS-LS2-1

Students who demonstrate understanding can:

Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.

Clarification Statement:
Emphasis is on cause and effect relationships between resources and growth of individual organisms and the numbers of organisms in ecosystems during periods of abundant and scarce resources.

Assessment Boundary:
The model should focus on organisms' needs and how resources in the ecosystem meet those needs. Determining the carrying capacity of ecosystems is beyond the intent.

Crosscutting Concepts: Cause and Effect

- Cause and effect relationships may be used to predict phenomena in natural or designed systems.

Oklahoma Academic Standards Connections

ELA/Literacy	Mathematics

Connection to PASS Coming Soon

Resources

- Project Wild
- Current events
- Prairie Chicken/Wind farms
- Identification of adaptations
- Form is determined by function
- Pearson Interactive Science—Chapter 8: Populations and Communities

Academic Vocabulary

Abiotic, biotic, population, ecosystem, predator, prey

MS-LS2-2 Ecosystems: Interactions, Energy, and Dynamics

Science & Engineering Practices	Disciplinary Core Ideas	Performance Expectations
❶ Asking questions (for science) and defining problems (for engineering) ❷ Developing and using models ❸ Planning and carrying out investigations ❹ Analyzing and interpreting data ❺ Using mathematics and computational thinking ⦿ **Constructing explanations (for science) and designing solutions (for engineering)** **Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.** • **Construct an explanation that includes qualitative or quantitative relationships between variables that predict phenomena.** ❼ Engaging in argument from evidence ❽ Obtaining, evaluating, and communicating information	**Interdependent Relationships in Ecosystems:** • 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.	**MS-LS2-2** *Students who demonstrate understanding can:* **Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.** **Clarification Statement:** Emphasis is on predicting consistent patterns of interactions in different ecosystems in terms of the relationships among and between organisms and abiotic components of ecosystems. Examples of types of interactions could include competitive, predatory, and mutually beneficial (e.g., competition, predation, parasitism, commensalism, mutualism). **Assessment Boundary:** Assessment should provide evidence that students can explain the consistency for the interactions of organisms with other organisms and/or the environment across different ecosystems (e.g., ocean, forests, wetlands, deserts, terrariums, cities).

Crosscutting Concepts: Patterns
- Patterns can be used to identify cause and effect relationships.

Oklahoma Academic Standards Connections

ELA/Literacy	Mathematics

Connection to *PASS* Coming Soon

Resources
- Predator/Prey
- Competitive
- Mutually beneficial
- Pearson Interactive Science—Chapter 9: Balance Within Ecosystems

Academic Vocabulary
Competition, predation, parasitism, commensalism, mutualism

MS-LS2-3 Ecosystems: Interactions, Energy, and Dynamics

Science & Engineering Practices	Disciplinary Core Ideas	Performance Expectations
❶ Asking questions (for science) and defining problems (for engineering) ❷ **Developing and using models** **Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.** • **Develop a model to describe phenomena.** ❸ Planning and carrying out investigations ❹ Analyzing and interpreting data ❺ Using mathematics and computational thinking ⊙ Constructing explanations (for science) and designing solutions (for engineering) ❼ Engaging in argument from evidence ❽ Obtaining, evaluating, and communicating information	**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 environments. • The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem.	**MS-LS2-3** *Students who demonstrate understanding can:* **<u>Develop a model to describe</u> the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.** **Clarification Statement:** Emphasis is on describing the conservation of matter and flow of energy into and out of various ecosystems, and on defining the boundaries of the system. **Assessment Boundary:** Assessment does not include the use of chemical reactions to describe the processes.

Crosscutting Concepts: Energy and Matter

• The transfer of energy can be tracked as energy flows through a natural system.

Oklahoma Academic Standards Connections

ELA/Literacy	Mathematics

Connection to PASS Coming Soon

Resources

- Food webs
- Model of Food Chains
- Energy Pyramid flip book
- Pearson Interactive Science—Chapter 8: Populations and Communities

Academic Vocabulary

Producers, consumers, decomposers

6-8

MS-LS2-4 Ecosystems: Interactions, Energy, and Dynamics

Science & Engineering Practices	Disciplinary Core Ideas	Performance Expectations
❶ Asking questions (for science) and defining problems (for engineering) ❷ Developing and using models ❸ Planning and carrying out investigations ❹ Analyzing and interpreting data ❺ Using mathematics and computational thinking ⦿ Constructing explanations (for science) and designing solutions (for engineering) ❼ **Engaging in argument from evidence** **Engaging in argument from evidence in 6–8 builds on K– 5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s).** • **Construct an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.** ❽ Obtaining, evaluating, and communicating information	**Ecosystem 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.	**MS-LS2-4** *Students who demonstrate understanding can:* **Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.** **Clarification Statement:** Emphasis is on recognizing patterns in data and making warranted inferences about changes in populations, and on evaluating empirical evidence supporting arguments about changes to ecosystems. **Assessment Boundary:** N/A

Crosscutting Concepts: Stability and Change

- Small changes in one part of a system might cause large changes in another part.

Oklahoma Academic Standards Connections

ELA/Literacy	Mathematics

Connection to PASS Coming Soon

Resources

- Construct an argument
- Camouflage
- Beaks and Claws
- Debate: status quo versus change

Academic Vocabulary

Adaptations

6-8

MS-LS2-5 Ecosystems: Interactions, Energy, and Dynamics

Science & Engineering Practices	Disciplinary Core Ideas	Performance Expectations
❶ Asking questions (for science) and defining problems (for engineering) ❷ Developing and using models ❸ Planning and carrying out investigations ❹ Analyzing and interpreting data ❺ Using mathematics and computational thinking ⊙ Constructing explanations (for science) and designing solutions (for engineering) ❼ **Engaging in argument from evidence** **Engaging in argument from evidence in 6–8 builds on K– 5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s).** • **Evaluate competing design solutions based on jointly developed and agreed-upon design criteria.** ❽ Obtaining, evaluating, and communicating information	**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. **Biodiversity and Humans:** (secondary to MS-LS2-5) • 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. **Developing Possible Solutions:** (secondary to MS-LS2-5) • There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. ** Connections to Engineering, Technology, and Application of Science* **Influence of Engineering, Technology, and Science on Society and the Natural World:** • The use of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time.	**MS-LS2-5** *Students who demonstrate understanding can:* **<u>Evaluate competing design solutions</u> for maintaining biodiversity and ecosystem services.*** **Clarification Statement:** Examples of ecosystem services could include water purification, nutrient recycling, and prevention of soil erosion. Examples of design solution constraints could include scientific, economic, and social considerations. **Assessment Boundary:** N/A

Crosscutting Concepts: Stability and Change

• Small changes in one part of a system might cause large changes in another part.

Oklahoma Academic Standards Connections

ELA/Literacy	Mathematics

Connection to *PASS* Coming Soon

Resources

- Loss of biodiversity in rainforests
- System changes during the dust bowl

Academic Vocabulary

biodiversity

6-8

MS-ESS2-4 Earth's Systems

Science & Engineering Practices	Disciplinary Core Ideas	Performance Expectations
❶ Asking questions (for science) and defining problems (for engineering) ❷ **Developing and using models Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.** **• Develop a model to describe unobservable mechanisms.** ❸ Planning and carrying out investigations ❹ Analyzing and interpreting data ❺ Using mathematics and computational thinking ⊙ Constructing explanations (for science) and designing solutions (for engineering) ❼ Engaging in argument from evidence ❽ Obtaining, evaluating, and communicating information	**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. • Global movements of water and its changes in form are propelled by sunlight and gravity.	**MS-ESS2-4** *Students who demonstrate understanding can:* **Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.** **Clarification Statement:** Emphasis is on the ways water changes its state as it moves through the multiple pathways of the hydrologic cycle. Examples of models can be conceptual or physical. **Assessment Boundary:** A quantitative understanding of the latent heats of vaporization and fusion is not assessed.

Crosscutting Concepts: Energy and Matter

- Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter.

Oklahoma Academic Standards Connections

ELA/Literacy	Mathematics

Connection to *PASS* Coming Soon

Resources

- Complete with LS 2-1

Academic Vocabulary

Hydrologic cycle, transpiration, evaporation, condensation, crystallization, precipitation

6-8

MS-ESS3-3 Earth and Human Activity

Science & Engineering Practices	Disciplinary Core Ideas	Performance Expectations
❶ Asking questions (for science) and defining problems (for engineering) ❷ Developing and using models ❸ Planning and carrying out investigations ❹ Analyzing and interpreting data ❺ Using mathematics and computational thinking ⊙ **Constructing explanations (for science) and designing solutions (for engineering)** **Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.** • **Apply scientific principles to design an object, tool, process or system.** ❼ Engaging in argument from evidence ❽ Obtaining, evaluating, and communicating information	**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. • 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. _________ ** Connections to Engineering, Technology, and Application of Science* **Influence of Engineering, Technology, and Science on Society and the Natural World:** • The use of technologies and any limitations on their use are driven by individual or societal needs, desires, and differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time.	**MS-ESS3-3** *Students who demonstrate understanding can:* **Apply scientific principles to design a method for monitoring and minimizing human impact on the environment.*** **Clarification Statement:** Examples of the design process include examining human environmental impacts, assessing the kinds of solutions that are feasible, and designing and evaluating solutions that could reduce that impact. Examples of human impacts can include water usage (such as the withdrawal of water from streams and aquifers or the construction of dams and levees), land usage (such as urban development, agriculture, or the removal of wetlands), and pollution (such as of the air, water, or land).

Crosscutting Concepts: Cause and Effect

•Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation.

Oklahoma Academic Standards Connections

ELA/Literacy	Mathematics

Connection to *PASS* Coming Soon

Resources

- Culminating project for all Life Science objectives: how to monitor and minimize human impact, green design

Academic Vocabulary

Extinction, urban, aquifer

6–8

sources of evidence consistent with scientific ideas, principles, and theories.