Readington Township Public Schools

Science Grades 6-8
Middle School

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Readington Township Public Schools
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I. OVERVIEW

The New Jersey Student Learning Standards - Science (NJSLS) are based on the Next Generation Science Standards (NGSS) and "Framework for K–12 Science Education" that was created by the National Research Council. They have three dimensions that are integrated into instruction at all levels. The first is core ideas, which consists of specific content and subject areas. The second is science and engineering practices. Students are expected not just to learn content but to understand the methods of scientists and engineers. The third is **cross-cutting concepts:** key underlying ideas that are common to a number of topics. The NGSS give equal emphasis to engineering design and to scientific inquiry. A high-quality science education means that students will develop an in-depth understanding of content and develop key skills—communication, collaboration, inquiry, problem solving, and flexibility—that will serve them throughout their educational and professional lives. (www.nextgenscience.org)

II. STUDENT OUTCOMES (Linked to NJSLS-Science)

- Physical Science
  - MS.PS1: Matter and Its Interactions
  - MS.PS2: Motion and Stability: Forces and Interactions
  - MS.PS3: Energy
  - MS.PS4: Waves and Their Applications in Technology for Information Transfer
- Life Science
  - MS.LS1: From Molecules to Organisms
  - MS.LS2: Ecosystems, Interactions, Energy, and Dynamics
  - MS.LS3: Heredity: Inheritance and Variations of Traits
  - MS.LS4: Biological Evolution: Unity and Diversity
- Earth Science
  - MS.ESS1: Earth's Place in the Universe
  - MS.ESS2: Earth Systems
  - MS.ESS3: Earth and Human Activity
- Engineering Design
  - MS.ETS1.A: Defining and Delimiting Engineering Problems
  - MS.ETS1.B: Developing Possible Solutions
  - MS.ETS1.C: Optimizing the Design Solution

III. STRATEGIES

- Group discussions
- Teacher presentations
- Student projects
- Guided groups
- One to one instruction
- Interactive SmartBoard lessons
- Tutorials
- Online Simulations (gizmos, SciPacks)
- Inquiry Labs (teacher demos, teacher guided, student created)
- Videos
- Teacher Demonstrations
- Scientific Experiments

IV. ACCOMMODATIONS

- Accommodations and Modification Addendum

V. ASSESSMENTS

- **Formative**
  - Teacher Observations
  - Do Nows
  - Exit Tickets
  - Independent Class work
  - Homework
  - Labs
  - Quizzes

- **Summative**
  - End of Unit Assessments
  - Unit Project
  - Explanations for Analogous Phenomena

- **Alternative**
  - Poster Presentation
  - Persuasive Letter
  - Simulations
- **Benchmark**
  - Sixth Grade
    - Earth Science and Physical Science Grade Level Benchmark
  - Seventh Grade
    - Life Science and Physical Science Grade Level Benchmark
  - Eighth Grade
    - Earth Science and Life Science Grade Level Benchmark

VI. Materials

- **Core**
  - Discovery Education Science Techbook
- **Supplemental**
  - Explore Learning Gizmos
  - McGraw-Hill iScience textbook
  - PhET simulations
  - YouTube
  - EdPuzzle
  - Newsela
  - CK-12
  - Teacher created materials

VII. SCOPE AND PACING

MS-ETS1: Engineering Design
Performance Expectations

Students who demonstrate understanding can:
• **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.
• **MS-ETS1-2** Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
• **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.
• **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.

Disciplinary Core Ideas

- **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-ETS1-1)
- **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-ETS1-4) There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-ETS1-2), (MS-ETS1-3) Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. (MSETS1-3) Models of all kinds are important for testing solutions. (MS-ETS1-4)
- **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. (MS-ETS1-3) 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-ETS1-4)

Science and Engineering Practices	Cross-Cutting Concepts
• **Asking Questions and Defining Problems** Asking questions and defining problems in grades 6–8 builds on K–5 experiences and progresses to specifying relationships between variables and clarifying arguments and models. Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions. (MS-ETS1-1) • **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 generate data to test ideas about designed systems, including those representing inputs and outputs. (MS-ETS1-4) • **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 determine	• **Influence of Science, Engineering, and Technology on Society and the Natural World** All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. (MS-ETS1-1) The uses of technologies and 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. (MS-ETS1-1)

similarities and differences in findings. (MS-ETS1-3) • **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. Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS-ETS1-2)	

Sixth Grade
Earth Science
Space Systems

Performance Expectations

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. [Clarification Statement: Examples of models can be physical, graphical, or conceptual.]
MS-ESS1-2. Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system. [Clarification Statement: Emphasis for the model is on gravity as the force that holds together the solar system and Milky Way galaxy and controls orbital motions within them. Examples of models can be physical (such as the analogy of distance along a football field or computer visualizations of elliptical orbits) or conceptual (such as mathematical proportions relative to the size of familiar objects such as students' school or state).] [Assessment Boundary: Assessment does not include Kepler's Laws of orbital motion or the apparent retrograde motion of the planets as viewed from Earth.]
MS-ESS1-3. Analyze and interpret data to determine scale properties of objects in the solar system. [Clarification Statement: Emphasis is on the analysis of data from Earth-based instruments, space-based telescopes, and spacecraft to determine similarities and differences among solar system objects. Examples of scale properties include the sizes of an object's layers (such as crust and atmosphere), surface features (such as volcanoes), and orbital radius. Examples of data include statistical information, drawings and photographs, and models.] [Assessment Boundary: Assessment does not include recalling facts about properties of the planets and other solar system bodies.]

Enduring Understandings/Big Ideas:	**Essential Questions:**
• Motions of Earth and the moon in relation to one another and the sun produce seasons, moon phases, and eclipses. • Objects in the solar system are classified based on similarities and differences observed from data obtained by a variety of instruments.	• How does Earth move? • Why is Earth warmer at the equator and colder at the poles? • Why do the seasons change as Earth moves around the sun? • How does the Moon move around Earth • Why does the Moon's appearance change? • What is a solar eclipse? • What is a lunar eclipse? • How does Earth compare to other objects in the solar system? • Astronomical Units

Disciplinary Core Ideas

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. (MS-ESS1-1)
- Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe. (MS-ESS1-2)

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. (MS-ESS1-2),(MS-ESS1-3)
- 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. (MS-ESS1- 1)
- The solar system appears to have formed from a disk of dust and gas, drawn together by gravity. (MS-ESS1-2)

Science and Engineering Practices	Cross-Cutting Concepts
Developing and Using Models • Develop and use a model to describe phenomena. (MS-ESS1-1),(MS-ESS1-2) **Analyzing and Interpreting Data** • Analyze and interpret data to determine similarities and differences in findings. (MSESS1-3)	**Patterns** • Patterns can be used to identify cause and effect relationships. (MS-ESS1-1) **Scale, Proportion, and Quantity** • Time, space and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (MS-ESS1- 3) **Systems and System Models** • Models can be used to represent systems and their interactions. (MS-ESS1-2)

Unit Pacing

Lessons And Time Frame (30 days)

- Seasons (13 days)
- Moon Phases (4 days)
- Eclipses (solar and lunar) (3 days)
- Scale Properties (8 days)
- Gravity (2 days)

Interdisciplinary Connections

- **21st Century Skills**
  - **Career Ready Practices**
    - **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.
    - **CRP4.** Communicate clearly and effectively and with reason.
      Activity: Students use models, daylight/darkness and temperature, and seasons Gizmo to explain seasonal variations around the globe.
  - **9.2 Career Awareness, Exploration, and Preparation**
    - **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.
    - **9.2.8.B.7** Evaluate the impact of online activities and social media on employer decisions.
      Activity: Introductory use of technology lesson and navigate online resources.

- **Technology**
  - **MS-ESS1-3.** Analyze and interpret data to determine scale properties of objects in the solar system.

- **8.1.8.A.4** Graph and calculate data within a spreadsheet and present a summary of the results
  Activity: Students graph daylight and darkness using Google Sheets.

- **Core Content Connections**
  - **Science/Math**
    MS-ESS1-3. Analyze and interpret data to determine scale properties of objects in the solar system.
    CCSS.MATH.CONTENT.6.RP.A.1
    Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.
    Activity: Analyze and interpret graphs of daylight and darkness from several worldwide locations at different latitudes.
  - **ELA/Literacy**
    RST.6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.
    (MS-ESS2-3),(MS-ESS2-5)
    Activity: Students will read and watch a video to compare and contrast characteristics and the relative size of the inner and outer planets.

Sixth Grade
Physical Science
Forces and Interactions

Performance Expectations

MS-PS2-1. Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.* [Clarification Statement: Examples of practical problems could include the impact of collisions between two cars, between a car and stationary objects, and between a meteor and a space vehicle.] [Assessment Boundary: Assessment is limited to vertical or horizontal interactions in one dimension.]

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. [Clarification Statement: Emphasis is on balanced (Newton's First Law) and unbalanced forces in a system, qualitative comparisons of forces, mass and changes in motion (Newton's Second Law), frame of reference, and specification of units.] [Assessment Boundary: Assessment is limited to forces and changes in motion in one-dimension in an inertial reference frame and to change in one variable at a time. Assessment does not include the use of trigonometry.]

MS-PS2-3. 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.]

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. [Clarification Statement: Examples of evidence for arguments could include data generated from simulations or digital tools; and charts displaying mass, strength of interaction, distance from the Sun, and orbital periods of objects within the solar system.] [Assessment Boundary: Assessment does not include Newton's Law of Gravitation or Kepler's Laws.]

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. [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 is limited to qualitative evidence for the existence of fields.]

Enduring Understandings/Big Ideas:

- Forces change the movement of objects.
- The strength of forces vary.
- Forces can be attractive or repulsive.

Essential Questions:

- What are some contact forces and some non-contact forces?
- What is the law of universal gravitation?
- How does friction affect the motion of two objects sliding past each other?
- What is Newton's 2nd law of motion?
- What is Newton's 3rd law of motion?
- Why don't the forces in a force pair cancel each other?
- What is the law of conservation of momentum?

Disciplinary Core Ideas

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). (MS-PS2-1)
- 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. (MS-PS2-2)
- 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. (MS-PS2-2)

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. (MS-PS2-3)
- 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. (MS-PS2-4)
- 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)

Science and Engineering Practices	Cross-Cutting Concepts
Asking Questions and Defining Problems • Ask questions that can be investigated	**Cause and Effect** • Cause and effect relationships may be used

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. (MS-PS2-3)

Planning and Carrying Out Investigations

- 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. (MS-PS2-2)
- 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. (MS-PS2-5) Constructing

Explanations and Designing Solutions

- Apply scientific ideas or principles to design an object, tool, process or system. (MS-PS2-1)

Engaging in Argument from Evidence

- Construct and present oral and written arguments 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. (MS-PS2-4)

to predict phenomena in natural or designed systems. (MS-PS2-3),(MS-PS2- 5)

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. (MS-PS2-1),(MS-PS2-4),

Stability and Change

- Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales. (MS-PS2-2)

Unit Pacing

Lessons And Timeframe (40 days)

- Gravity (2 days)
- 1st Law (inertia) (3 days)
- 2nd Law (F=ma) (5 days)
- 3rd Law (equal and opposite) (10 days)
- Strength of Electric and Magnetic Forces (10 days)
- Electric and Magnetic Fields (10 days)

Interdisciplinary Connections

- **21st Century Skills**
  - **Career Ready Practices**
    - **MS-PS2-1.** Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.
      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.
      CRP12. Work productively in teams while using cultural global competence.
      Activity: Students work in teams to collect and analyze data for Newtons 3 laws.
  - **9.2 Career Awareness, Exploration, and Preparation**

- **MS-PS2-1.** Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.
  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.
  9.2.8.B.3 Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.
  Activity: Students will work together to plan an investigation and.or design a solution, collecting data and communicating assigned jobs.

- **Technology**
  - **MS-PS2-1.** Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.
    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.
    8.1.8.A.5 Create a database query, sort and create a report and describe the process, and explain the report results.
    Activity: Students create a report that explains the results of their Newton's Law experiments.
- **Core Content Connections**
  - **Science/Math**
    MS-PS2-1. Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.
    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.
    7.EE.B.3 Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form, using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. (MS-PS2-1),(MS-PS2-2)
    Activity: After collecting data for penny loads, students determine reasonableness of answers with increasing mass.
  - **Science/ELA-Literacy**
    RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. **(MS-PS2-1),(MS-PS2-2),(MS-PS2- 5)**
    Activity: Students run a controlled, multi-step experiment to collect force, mass, and acceleration data of the balloon rocket.

6th Grade
Physical Science
Structure and Properties of Matter

Performance Expectations

MS-PS1-1. Develop models to describe the atomic composition of simple molecules and extended structures. [Clarification Statement: Emphasis is on developing models of molecules that vary in complexity. Examples of simple molecules could include ammonia and methanol. Examples of extended structures could include sodium chloride or diamonds. Examples of molecular-level models could include drawings, 3D ball and stick structures, or computer representations showing different molecules with different types of atoms.] [Assessment Boundary: Assessment does not include valence electrons and bonding energy, discussing the ionic nature of subunits of complex structures, or a complete depiction of all individual atoms in a complex molecule or extended structure.]
MS-PS1-3. Gather and make sense of information to describe that synthetic materials come from natural resources and impact society. [Clarification Statement: Emphasis is on natural resources that undergo a chemical process to form the synthetic material. Examples of new materials could include

new medicine, foods, and alternative fuels.] [Assessment Boundary: Assessment is limited to qualitative information.]

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. [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.]

Enduring Understandings/Big Ideas:	**Essential Questions:**
• All types of matter, elements, compounds, and mixtures are made of atoms. • Physical and energy changes occur as the matter goes from one state to another.	• What is the smallest unit of matter? • What are some physical properties of matter? • How do particles move in solids, liquids, and gasses? • How are the forces between particles different in solids, liquids, and gasses? • How is temperature related to particle motion? • How are temperature and thermal energy different? • What happens to thermal energy when matter changes from one state to another?

Disciplinary Core Ideas

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. (MS-PS1-1)
- Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. (MS-PS1-3) (Note: This Disciplinary Core Idea is also addressed by MS-PS1-2.)
- Gasses and liquids are made of molecules or inert atoms that are moving about relative to each other. (MS-PS1-4)
- 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. (MS-PS1-4)
- Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). (MS-PS1-1)
- The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter. (MS-PS1-4)

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. (MS-PS1-3) (Note: This Disciplinary Core Idea is also addressed by MS-PS1-2 and MS-PS1-5.)

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 meaning; it refers to the energy transferred due to the temperature difference between two objects. (secondary to MSPS1-4)
- 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. (secondary to MS-PS1-4)

Science and Engineering Practices	Cross-Cutting Concepts
Developing and Using Models • phenomena. (MS-PS1-1),(MS-PS1-4) **Obtaining, Evaluating, and Communicating Information** • Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence. (MS-PS1-3)	**Cause and Effect** • Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS1-4) **Scale, Proportion, and Quantity** • Time, space and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (MS-PS1-1) **Structure and Function** • Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. (MS-PS1-3) **Interdependence of Science, Engineering, and Technology** • Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems. (MS-PS1-3) • Influence of Science, Engineering and Technology on Society and the Natural World The uses 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-PS1-3)

Unit Pacing

Lessons And Timeframe (30 days)

- Atomic Composition (10 days)
- Properties of Synthetic Materials (10 days)
- Change of State (10 days)

Interdisciplinary Connections

- **21st Century Skills**

- **Career Ready Practices**
  - **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.
    CRP2. Apply appropriate academic and technical skills.
    Activity: Students develop models of molecular motion when thermal energy is added or removed.

- **9.2 Career Awareness, Exploration, and Preparation**
  - **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.
    9.2.8.B.3 Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.
    Activity: Students work in groups to create models and collect data when thermal energy is added or removed.

- **Technology**
  - **MS-PS1-1**. Develop models to describe the atomic composition of simple molecules and extended structures.
    8.1.8.A.2 Create a document (e.g. newsletter, reports, personalized learning plan,business letters or flyers) using one or more digital applications to be critiqued by professionals for usability.
    Activity: Students created an infographic for physical properties of simple molecules to be reviewed by peers.

- **Core Content Connections**
  - **Science/Math**
    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.NS.C.5 Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation. (MS-PS1-4)
    Activity: Students measure temperature before, during, and after endo- and exothermic reactions.
  - **Science/ ELA-Literacy**
    RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. **(MS-PS1-6)**
    Activity: Students run a controlled, multi-step experiment to collect data on reactants, products, and temperature.

Sixth Grade
Physical Science
Chemical Reactions

Performance Expectations

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. [Clarification Statement: Examples of reactions could include burning sugar or steel wool, fat reacting with sodium hydroxide, and mixing zinc with hydrogen chloride.] [Assessment Boundary: Assessment is limited to analysis of the following properties: density, melting point, boiling point, solubility, flammability, and odor.]
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. [Clarification Statement: Emphasis is on law of

conservation of matter and on physical models or drawings, including digital forms, that represent atoms.] [Assessment Boundary: Assessment does not include the use of atomic masses, balancing symbolic equations, or intermolecular forces.]
MS-PS1-6. Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.* [Clarification Statement: Emphasis is on the design, controlling the transfer of energy to the environment, and modification of a device using factors such as type and concentration of a substance. Examples of designs could involve chemical reactions such as dissolving ammonium chloride or calcium chloride.] [Assessment Boundary: Assessment is limited to the criteria of amount, time, and temperature of substance in testing the device.]

Enduring Understandings/Big Ideas:	**Essential Questions:**
• Matter is identified based on physical and chemical properties. • Substances chemically react and create new substances with different properties. • Mass is conserved and does not change. • Thermal Energy can be released or absorbed by chemical processes.	• What is a chemical property? • What are some signs of chemical change? • How can a change in energy affect the state of matter? • What is meant by conservation of mass? • In what ways can thermal energy be transferred?

Disciplinary Core Ideas

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. (MS-PS1-2) (Note: This Disciplinary Core Idea is also addressed by MS-PS1-3.)

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. (MS-PS1-2),(MS-PS1-*5*) (Note: This Disciplinary Core Idea is also addressed by MS-PS1-3.)
- The total number of each type of atom is conserved, and thus the mass does not change. (MS-PS1-*5*)
- Some chemical reactions release energy, others store energy. (MS-PS1-6)

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. (secondary to MS-PS1-6)

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 the characteristics may be incorporated into the new design. (secondary to MS-PS1-6) 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. (secondary to MS-PS1-6)

Science and Engineering Practices	**Cross-Cutting Concepts**
Developing and Using Models . • Develop a model to describe unobservable mechanisms. (MS-PS1-*5*) **Analyzing and Interpreting Data** • Analyze and interpret data to determine similarities and differences in findings. (MS-PS1-2) **Constructing Explanations and Designing**	**Patterns** • Macroscopic patterns are related to the nature of microscopic and atomic-level structure. (MS-PS1-2) **Energy and Matter** • Matter is conserved because atoms are conserved in physical and chemical processes. (MS-PS1-*5*) The transfer of

Solutions • Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints. (MSPS1-6)	energy can be tracked as energy flows through a designed or natural system. (MS-PS1-6)

Unit Pacing

Lessons And Timeframe (35 days)

- Properties of Substances (15 days)
- Law of Conservation (5 days)
- Chemical Processes Design Project -- Release/Absorb Thermal Energy (15 days)

Interdisciplinary Connections

- **21st Century Skills**
  - **Career Ready Practices**
    - **MS-PS1-6**. Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.
      CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
      Activity: Students create a container that keeps items either hot or cold
  - **9.2 Career Awareness, Exploration, and Preparation**
    MS-PS1-6. Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.
    9.2.8.B.3 Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.
    Activity: Students collaboratively create a container that keeps items either hot or cold, and communicate their design to the class.
- **Technology**
  - **MS-PS1-6**. Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.
    8.1.8.A.1 Demonstrate knowledge of a real world problem using digital tools.
    Activity: Students research through various databases for how to create a container to either keep items hot or cold and use the information from the research as evidence for an advertisement.
- **Core Content Connections**
  - **Science/Math**
    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.
    MP.4 Model with mathematics. (MS-PS1-1),(MS-PS1-5)
    Activity: Create a model to show the conservation of mass.
  - **ELA/Literacy**
    RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. **(MS-PS1-6)**
    Activity: Students run a controlled, multi-step experiment to collect data on conservation of mass.

Sixth Grade
Physical Science
Energy

Performance Expectations
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. [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.] **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.** [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.] **MS-PS3-3. Apply scientific principles to design, construct, and test 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.] [Assessment Boundary: Assessment does not include calculating the total amount of thermal energy transferred.] **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.** [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.] **MS-PS3-5. Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.** [Clarification Statement: Examples of empirical evidence used in arguments could include an inventory or other representation of the energy before and after the transfer in the form of temperature changes or motion of object.] [Assessment Boundary: Assessment does not include calculations of energy.]

Enduring Understandings/Big Ideas:	Essential Questions:
• Energy is the ability to cause change. • Energy can be transferred from one object or system to another.	• What is energy? • What are potential and kinetic energy? • What is temperature? • How is energy related to work? • What is the law of conservation of energy? • How can energy be transferred from one object or system to another?

Disciplinary Core Ideas
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. (MS-PS3-1) • A system of objects may also contain stored (potential) energy, depending on their relative positions. (MS-PS3-2) • 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. (MS-PS3-3),(MS-PS3-4)

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. (MS-PS3-*5*)
- 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)
- Energy is spontaneously transferred out of hotter regions or objects and into colder ones. (MS-PS3-3)

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. (MS-PS3-2)

Science and Engineering Practices	Cross-Cutting Concepts
Developing and Using Models • Develop a model to describe unobservable mechanisms. (MS-PS3-2) **Planning and Carrying Out Investigations** • 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. (MS-PS3-4) **Analyzing and Interpreting Data** • Construct and interpret graphical displays of data to identify linear and nonlinear relationships. (MS-PS3-1) **Constructing Explanations and Designing Solutions** • Apply scientific ideas or principles to design, construct, and test a design of an object, tool, process or system. (MS-PS3-3) **Engaging in Argument from Evidence** • Construct, use, and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon. (MS-PS3-*5*)	**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. (MS-PS3-1),(MS-PS3-4) **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. (MS-PS3-2) **Energy and Matter** • Energy may take different forms (e.g. energy in fields, thermal energy, energy of motion). (MS-PS3- *5*) The transfer of energy can be tracked as energy flows through a designed or natural system. (MSPS3-3)

Unit Pacing

Lessons And Time Frame (30 days)

- Kinetic Energy (10 days)
- Potential Energy (10 days)
- Thermal Energy (10 days)

Interdisciplinary Connections

- **21st Century Skills**
  - **Career Ready Practices**

MS-PS3-5. Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.
CRP6. Demonstrate creativity and innovation.
Activity: Students create a Rube Goldberg Machine

- **9.2 Career Awareness, Exploration, and Preparation**
  - **MS-PS3-3**. Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.*
    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.
    MS-PS3-5. Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.
    9.2.8.B.4 Evaluate how traditional and nontraditional careers have evolved regionally, nationally, and globally.
    Activity: Students research alternative energy and careers in that field, including energy efficiency and areas of best use.

- **Technology**
  - **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.
    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.
    8.1.8.A.3 Use and/or develop a simulation that provides an environment to solve a real world problem or theory.
    Activity: Students use a simulation to create their own skate park tracks to manipulate potential and kinetic energy.
- **Core Content Connections**
  - **Science/Math**
    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.
    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.
    7.RP.A.2 Recognize and represent proportional relationships between quantities.
    (MS-PS3-1),(MS-PS3-5)
    Activity: Students collect data to explain the relationship between kinetic and potential energy in the skate park simulation.
  - **Science/ELA-Literacy**
    WHST.6-8.7 Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. **(MS-PS3-3),(MS-PS3-4)**
    Activity: Students researched about energy transfer to create a Rube Goldberg Machine.

Seventh Grade
Life Science
Growth, Development, and Reproduction of Organisms

Performance Expectations

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. [Clarification Statement:

Examples of behaviors that affect the probability of animal reproduction could include nest building to protect young from cold, herding of animals to protect young from predators, and vocalization of animals and colorful plumage to attract mates for breeding. Examples of animal behaviors that affect the probability of plant reproduction could include transferring pollen or seeds, and creating conditions for seed germination and growth. Examples of plant structures could include bright flowers attracting butterflies that transfer pollen, flower nectar and odors that attract insects that transfer pollen, and hard shells on nuts that squirrels bury.]

MS-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. [Clarification Statement: Examples of local environmental conditions could include availability of food, light, space, and water. Examples of genetic factors could include large breed cattle and species of grass affecting growth of organisms. Examples of evidence could include drought decreasing plant growth, fertilizer increasing plant growth, different varieties of plant seeds growing at different rates in different conditions, and fish growing larger in large ponds than they do in small ponds.] [Assessment Boundary: Assessment does not include genetic mechanisms, gene regulation, or biochemical processes.]

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. [Clarification Statement: Emphasis is on conceptual understanding that changes in genetic material may result in making different proteins.] [Assessment Boundary: Assessment does not include specific changes at the molecular level, mechanisms for protein synthesis, or specific types of mutations.]

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. [Clarification Statement: Emphasis is on using models such as Punnett squares, diagrams, and simulations to describe the cause and effect relationship of gene transmission from parent(s) to offspring and resulting genetic variation.]

Enduring Understandings/Big Ideas:

- Sexual reproduction results in genetic variation among individuals of a species.
- Asexual reproduction occurs without meiosis or fertilization, allowing for organisms to reproduce quickly.
- Genes that code for traits are found on chromosomes.
- A mutation in the DNA can change a protein, causing the trait to change as well.

Essential Questions:

- What are the different ways by which organisms reproduce?
- What determines the expression of traits?
- How do changes in the DNA Pacing affect traits?

Disciplinary Core Ideas

LS1.B: Growth and Development of Organisms

- Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring. (secondary to MS-LS3-2)
- Animals engage in characteristic behaviors that increase the odds of reproduction. (MS-LS1-4)
- Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction. (MS-LS1-4)
- Genetic factors as well as local conditions affect the growth of the adult plant. (MS-LS1-5)

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 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. (MS-LS3-1)
- Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited. (MS-LS3-2)

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. (MS-LS3-2)
- 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. (MS-LS3-1)

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 on to offspring. (MS-LS4-5)

Science and Engineering Practices	Cross-Cutting Concepts
Developing and Using Models • Develop and use a model to describe phenomena. (MSLS3-1),(MS-LS3-2) **Constructing Explanations and Designing Solutions** • 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. (MS-LS1-5) **Engaging in Argument from Evidence** • Use 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. (MS-LS1-4) **Obtaining, Evaluating, and Communicating Information** • Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence. (MS-LS4-5)	**Cause and Effect** • Cause and effect relationships may be used to predict phenomena in natural systems. (MSLS3-2) Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (MS-LS1-4),(MS-LS1-5),(MS-LS4- 5) **Structure and Function** • Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the shapes, composition, and relationships among its parts, therefore complex natural structures/systems can be analyzed to determine how they function. (MS-LS3-1)

Unit Pacing

Lessons And Timeframe (30 days)

- Reproduction, growth, and development (10 days)
- Inheritance and variation of traits (15 days)
- Natural and artificial selection (5 days)

Interdisciplinary Connections

- **21st Century Skills**
  - **Career Ready Practices**
    - **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.
      CRP4. Communicate clearly and effectively and with reason.
      Activity: *Students will develop an argument using evidence, citing text, data, or media to support an explanation for how animal behaviors and specialized plant structures support successful reproduction.*

  - **9.2 Career Awareness, Exploration, and Preparation**
    - **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.
      9.2.8.B.3 Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.
      Activity: Through a group argument about the structure and function of plants and animals affecting successful reproduction, students will evaluate each others' productivity, contribution, and collaboration in their group.

- **Technology**
  - **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
    8.1.8.D.2 Demonstrate the application of appropriate citations to digital content
    Activity: *Students will research information about genetic information that is passed on to offspring through asexual and sexual reproduction and cite their sources*

- **Core Content Connections**
  - **ELA/Science**
    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.
    RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table)
    Activity: *Students will create a model to identify and describe adaptations in animals and plants by integrating visuals with text that allow for increased success in reproduction. Students will cite their sources on their models.*
  - ELA/Science
    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.
    WHST.6-8.1 Write arguments focused on discipline content
    Activity: *Students will develop an argument using evidence, citing text, data, or media to support an explanation for how animal behaviors and specialized plant structures support successful reproduction. Students will evaluate each others' arguments and offer feedback.*

Seventh Grade
Life Science
Interdependent Relationships in Ecosystems

Performance Expectations

MS-LS2-2. 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.]
MS-LS2-5. Evaluate competing design solutions 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.]

Enduring Understandings/Big Ideas:

- Organisms and their environments are interconnected.
- Changes in one part of the system will affect other parts of the system.
- Humans can alter the living and nonliving factors within an ecosystem, thereby creating changes to the overall system.

Essential Questions:

- What would happen if living things could not interact with the nonliving parts of the environment?
- How can change in one part of an ecosystem affect change in other parts of the ecosystem?
- How do humans have an impact on the diversity and stability of ecosystems?

Disciplinary Core Ideas

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. (MS-LS2-2)

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. (MS-LS2-5)

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. (secondary to MS-LS2-5)

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. (secondary to MS-LS2-5)

Science and Engineering Practices	Cross-Cutting Concepts
Constructing Explanations and Designing Solutions • Construct an explanation that includes qualitative or quantitative relationships	**Patterns** • Patterns can be used to identify cause and effect relationships. (MS-LS2-2) **Stability and Change**

between variables that predict phenomena. (MS-LS2-2)

Engaging in Argument from Evidence

- Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS-LS2-5)

- Small changes in one part of a system might cause large changes in another part. (MS-LS2-5)

Unit Pacing

Lessons And Timeframe (24 days)

- Interdependent relationships in ecosystems (12 days)
- Biodiversity and ecosystem services (12 days)

Interdisciplinary Connections

- **21st Century Skills**
  - **Career Ready Practices**
    - **MS-LS2-5.** Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
      CRP7. Employ valid and reliable research strategies.
      CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
      Activity: *Students will obtain and combine information from various online resources to investigate the causes for the changes in Yellowstone ecosystem for a period of 20 years.*
  - **9.2 Career Awareness, Exploration, and Preparation**
    - **MS-LS2-5.** Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
      9.2.8.B.3 Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.
      Activity: *As a group, students will identify patterns of change in the Yellowstone ecosystem and interpret them to determine the causes for these changes.*
- **Technology**
  - **MS-LS2-5.** Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
    8.1.8.E.1 Effectively use a variety of search tools and filters in professional public databases to find information to solve a real world problem
    8.1.8.A.4 Graph and calculate data within a spreadsheet and present a summary of the results
    Activity: *Students will share their findings of the changes to the Yellowstone ecosystem using graphical data and present a summary to their peers.*

- **Core Content Connections**
  - **Science/ELA**
    MS-LS2-2. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
    WHST.6-8.2 Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content
    SL.8.4 Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.
    Activity: *Students will develop a presentation that explains and predicts patterns of interactions among organisms across multiple ecosystems.*

- **Science/Math**
  MS-LS2-2. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
  6.SP.B.5 Summarize numerical data sets in relation to their context
  Activity: *Using evidence from multiple sources and given data, students will identify and describe patterns in competitive, predatory, and mutually beneficial interactions between organisms.*

Seventh Grade
Life Science
Matter and energy in Organisms and Ecosystems

Performance Expectations

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. [Clarification Statement: Emphasis is on tracing movement of matter and flow of energy.] [Assessment Boundary: Assessment does not include the biochemical mechanisms of photosynthesis.]
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. [Clarification Statement: Emphasis is on describing that molecules are broken apart and put back together and that in this process, energy is released.] [Assessment Boundary: Assessment does not include details of the chemical reactions for photosynthesis or respiration.]
MS-LS2-1. 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.]
MS-LS2-3. Develop a model to describe 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.]
MS-LS2-4. 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.]

Enduring Understandings/Big Ideas:	**Essential Questions:**
• Matter needed to sustain life is continually recycled among and between organisms and the environment. • Energy from the sun flows irreversibly through ecosystems and is conserved as organisms use and transform it.	• How do matter and energy link organisms to each other and their environments? • Why is sunlight essential to life on Earth?

Disciplinary Core Ideas

LS1.C: 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. (MS-LS1-6)
- 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. (MS-LS1-7)

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. (MS-LS2-1)
- 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. (MS-LS2- 1)
- Growth of organisms and population increases are limited by access to resources. (MS-LS2-1)

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 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)

LS2.C: 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)

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. (secondary to MS-LS1-6)
- 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. (secondary to MS-LS1-7)

Science and Engineering Practices	Cross-Cutting Concepts
Developing and Using Models • Develop a model to describe phenomena. (MS-LS2-3) • Develop a model to describe unobservable mechanisms. (MS-LS1-7) **Analyzing and Interpreting Data** • Analyze and interpret data to provide evidence for phenomena. (MS-LS2-1) **Constructing Explanations and Designing Solutions** • 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. (MS-LS1-6) **Engaging in Argument from Evidence** • Construct an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an	**Cause and Effect** • Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-LS2-1) **Energy and Matter** • Matter is conserved because atoms are conserved in physical and chemical processes. (MS-LS1-7) • Within a natural system, the transfer of energy drives the motion and/or cycling of matter. (MS-LS1-6) • The transfer of energy can be tracked as energy flows through a natural system. (MSLS2-3) **Stability and Change** • Small changes in one part of a system might cause large changes in another part. (MSLS2-4)

explanation or a model for a phenomenon or a solution to a problem. (MS-LS2-4)	

Unit Pacing

Lessons And Timeframe (24 days)

- Flow of energy and matter in organisms (12 days)
- Flow of energy and matter in ecosystems (12 days)

Interdisciplinary Connections

- **21st Century Skills**
  - **Career Ready Practices**
    - **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
      CRP4. Communicate clearly and effectively and with reason.
      Activity: *Students will describe the role of photosynthesis in the cycling of matter and flow of energy using information obtained through various references.*
  - **9.2 Career Awareness, Exploration, and Preparation**
    - **MS-LS2-3.** Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.
      9.2.8.B.3 Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.
      Activity: Students will present their model of matter cycling and energy flowing through an ecosystem. Students will evaluate each others' models and offer feedback.
- **Technology**
  - **MS-LS2-3.** Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.
    MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
    8.1.8.E.1 Effectively use a variety of search tools and filters in professional public databases to find information to solve a real world problem.
    Activity: *Students will obtain information from a variety of resources to use as evidence in an argument that describes the causes of the decrease in the hawk population.*
- **Core Content Connections**
  - **ELA/Science**
    MS-LS2-3. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.
    RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram,model, graph, or table).
    Activity: *Students will develop a model that describes how matter cycles and energy flows through the living and nonliving parts of an ecosystem.*
  - **ELA/Science**
    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
    WHST.6-8.2 Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.

Activity: *Students will develop an explanation for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.*

Seventh Grade
Life Science
Structure, Function, and Information Processing

Performance Expectations

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. [Clarification Statement: Emphasis is on developing evidence that living things are made of cells, distinguishing between living and non-living things, and understanding that living things may be made of one cell or many and varied cells.]
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. [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.] [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.]
MS-LS1-3. 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.]
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. [Assessment Boundary: Assessment does not include mechanisms for the transmission of this information.]

Enduring Understandings/Big Ideas:
- Organisms share common characteristics of life.
- Cells have organized structures and systems necessary to maintain life.
- Structure is related to function at all levels of biological organization.

Essential Questions:
- How do you know if something is alive?
- How does life result from the structure and function of cells?
- How are cells organized in multicellular organisms?

Disciplinary Core Ideas

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). (MS-LS1-1)
- 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)
- 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)

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. (MS-LS1- 8)

Science and Engineering Practices	Cross-Cutting Concepts
Developing and Using Models • Develop and use a model to describe phenomena. (MS-LS1-2) **Planning and Carrying Out Investigations** • Conduct an investigation to produce data to serve as the basis for evidence that meet the goals of an investigation. (MS-LS1-1) **Engaging in Argument from Evidence** • Use an oral and written argument supported by evidence to support or refute an explanation or a model for a phenomenon. (MS-LS1-3) **Obtaining, Evaluating, and Communicating Information** • Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence. (MS-LS1-8)	**Cause and Effect** • Cause and effect relationships may be used to predict phenomena in natural systems. (MS-LS1-8) **Scale, Proportion, and Quantity** • Phenomena that can be observed at one scale may not be observable at another scale. (MS-LS1-1) **Systems and System Model**s • Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems. (MS-LS1-3) **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. (MS-LS1-2)

Unit Pacing

Lessons And Timeframe (35 days)

- Microscopes (5 days)
- Characteristics of life (5 days)
- Cell structure and function (15 days)
- Levels of organization (5 days)
- Information processing (5 days)

Interdisciplinary Connections

- **21st Century Skills**
  - **Career Ready Practices**
    - **MS-LS1-3.** Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells
      CRP12. Work productively in teams while using cultural global competence.
      Activity: *Students will work in a group to gather and analyze information to use as evidence to support the claim that the body is a system of interacting subsystems composed of a group of cells.*
    - **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.
      CRP11. Use technology to enhance productivity.

Activity: *Students will use various internet sources (Google Slides, Drawings, Prezi, Storyboard that, etc) to develop a presentation to support or refute the idea that sensory input results in memories or behavior change.*

- **9.2 Career Awareness, Exploration, and Preparation**
  - **MS-LS1-3.** Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells
    9.2.8.B.3 Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career
    Activity: *Students will evaluate each others' communication in their group presentation to support the claim that the body is a system of interacting subsystems composed of a group of cells.*

- **Technology**
  - **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.
    8.1.8.D.4 Assess the credibility and accuracy of digital content.
    Activity: *Students will research and analyze information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories. They will determine the credibility and accuracy of the information they found.*

- **Core Content Connections**
  - **ELA/Science**
    MS-LS1-3. Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells
    WHST.6-8.1 Write arguments focused on discipline content.
    Activity: *Students will construct a group argument, using evidence from investigations and literature, that supports the claim that the body is a system of interacting subsystems composed of a group of cells. Groups will present their argument to the class and receive feedback from peers about their argument.*
  - **ELA/Science**
    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.
    WHST.6-8.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.
    Activity: *Students will create a presentation that evaluates information based on credibility, accuracy, bias, and ability to support or refute the idea that sensory input results in memories or behavior change.*

Seventh
Physical Science
Waves and Electromagnetic Radiation

Performance Expectations

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. [Clarification Statement: Emphasis is on describing waves with both qualitative and quantitative thinking.] [Assessment Boundary: Assessment does not include electromagnetic waves and is limited to standard repeating waves.]

MS-PS4-2. Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials. [Clarification Statement: Emphasis is on both light and mechanical waves. Examples of models could include drawings, simulations, and written descriptions.] [Assessment Boundary: Assessment is limited to qualitative applications pertaining to light and mechanical waves.]
MS-PS4-3. Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals. [Clarification Statement: Emphasis is on a basic understanding that waves can be used for communication purposes. Examples could include using fiber optic cable to transmit light pulses, radio wave pulses in wifi devices, and conversion of stored binary patterns to make sound or text on a computer screen.] [Assessment Boundary: Assessment does not include binary counting. Assessment does not include the specific mechanism of any given device.]

Enduring Understandings/Big Ideas:

- A wave has a specific wavelength, frequency, and amplitude.
- Information can be transmitted using the wave's properties.
- Waves transfer energy when they interact with matter.

Essential Questions:

- How can energy be transferred from one object or system to another?
- What are the characteristic properties of waves and how can they be used?
- How do waves send digital information?
- How do waves behave when they interact with matter?

Disciplinary Core Ideas

PS4.A: Wave Properties

- A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude. (MS-PS4-1)
- A sound wave needs a medium through which it is transmitted. (MS-PS4-2)

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. (MS-PS4-2)
- 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. (MS-PS4-2)
- A wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media. (MS-PS4-2)
- However, because light can travel through space, it cannot be a matter wave, like sound or water waves. (MS-PS4-2) PS4.C: Information Technologies and Instrumentation Digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information. (MS-PS4-3)

PS4.C: Information Technologies and Instrumentation

- Digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information. (MS-PS4-3)

Science and Engineering Practices

Developing and Using Models

- Develop and use a model to describe phenomena. (MS-PS4-2)

Using Mathematics and Computational Thinking

- Use mathematical representations to describe and/or support scientific conclusions and design solutions. (MS-PS4-1)

Obtaining, Evaluating, and Communicating Information

- Integrate qualitative scientific and technical

Cross-Cutting Concepts

Patterns

- Graphs and charts can be used to identify patterns in data. (MS-PS4- 1)

Structure and Function

- Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. (MS-PS4-2)
- Structures can be designed to serve particular functions. (MS-PS4-3)

information in written text with that contained in media and visual displays to clarify claims and findings. (MS-PS4-3)	

Unit Pacing

Lessons And Timeframe (20 days)

- Wave properties (5 days)
- Electromagnetic radiation (10 days)
- Waves and information technology (5 days)

Interdisciplinary Connections

- **21st Century Skills**
  - **Career Ready Practices**
    - **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.
      CRP6. Demonstrate creativity and innovation.
      Activity: *Plan and carry out an investigation, using the resources available, to create a string telephone that will transfer the speaker's energy to a listener standing 8 meters away. The listener needs to be able to hear and understand what the speaker is saying in a noisy classroom.*
  - **9.2 Career Awareness, Exploration, and Preparation**
    - **MS-PS4-3.** Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.
      9.2.8.B.4 Evaluate how traditional and nontraditional careers have evolved regionally, nationally, and globally.
      Activity: *Research how telecommunication careers have changed throughout the years.*
- **Technology**
  - **MS-PS4-3.** Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.
    8.1.8.D.2 Demonstrate the application of appropriate citations to digital content
    Activity: *Obtain information from multiple online resources to use as evidence in an explanation for the uses of digital vs analog signals. Students will cite their resources in their explanation.*

- **Core Content Connections**
  - **MS-PS4-3.** Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.
    RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts.
    Activity: *Gather evidence from various sources to support a claim that using waves to carry digital signals is a more reliable way to encode and transmit information than using waves to carry analog signals.*
  - **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.
    MP.4 Model with mathematics.
    Activity: *Create a graph showing the relationship between the amplitude of a wave and the energy in a wave.*

Eighth Grade
Earth Science
Earth's Systems

Performance Expectations

MS-ESS2-1. Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process. [Clarification Statement: Emphasis is on the processes of melting, crystallization, weathering, deformation, and sedimentation, which act together to form minerals and rocks through the cycling of Earth's materials.] [Assessment Boundary: Assessment does not include the identification and naming of minerals.]

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. [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.]

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. [Clarification Statement: Emphasis is on how these resources are limited and typically non-renewable, and how their distributions are significantly changing as a result of removal by humans. Examples of uneven distributions of resources as a result of past processes include but are not limited to petroleum (locations of the burial of organic marine sediments and subsequent geologic traps), metal ores (locations of past volcanic and hydrothermal activity associated with subduction zones), and soil (locations of active weathering and/or deposition of rock).]

Enduring Understandings/Big Ideas:

- The matter within rocks are constantly going through different processes of weathering.
- Water goes through many different phases and is involved in many different processes that can model and shape the Earth.
- Humans require resources and have been removing them from Earth and the location of these resources depends on years of formation underground.

Essential Questions:

- How do the materials in and on Earth's crust change over time?
- How does water influence weather, circulate in the oceans, and shape Earth's surface?

Disciplinary Core Ideas

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. (MS-ESS2-1)

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. (MS-ESS2-4)
- Global movements of water and its changes in form are propelled by sunlight and gravity. (MS-ESS2-4)

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 resources are distributed unevenly around the planet as a result of past geologic processes. (MS-ESS3-1)

Science and Engineering Practices	Cross-Cutting Concepts
Developing and Using Models • Develop and use a model to describe phenomena. (MSESS2-1) Develop a model to describe unobservable mechanisms. (MS-ESS2-4) **Constructing Explanations and Designing Solutions** • 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. (MS-ESS3-1)	**Cause and Effect** • Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-ESS3-1) **Energy and Matter** • Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter. (MS-ESS2-4) **Stability and Change** • Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and processes at different scales, including the atomic scale. (MSESS2-1)

Unit Pacing

Lessons And Timeframe (22 days)

- Rock Cycle (5 days)
- Types of Rocks (5 days)
- Water Cycle (3 days)
- Carbon and Nitrogen cycles (5 days)
- Fossil Fuels with renewable and nonrenewable resources (4 days)

Interdisciplinary Connections

- **21st Century Skills**
  - **Career Ready Practices**

    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.

    CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.

    Activity:Students will research geological processes and use critical thinking to explain how the Grand Canyon was formed.

  - **9.2 Career Awareness, Exploration, and Preparation**
    - **MS-ESS2-**1. Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.

      9.2.8.B.3 Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.

      Activity: Work collaboratively to develop a model of the carbon cycle and how it is impacted by plastic pollution.
- **Technology**

  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.

  8.1.8.A.3 Use and/or develop a simulation that provides an environment to solve a real world problem or theory.

Activity: Students will use a simulation to help explain how the Grand Canyon was formed.

- **Core Content Connections**
  - **Math**

    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.

    7.EE.B.4 Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.

    8.EE.3. Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. How can scientific notation and units of appropriate size be used to represent measurements of very large or very small quantities?

    8.EE.4 Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities

    (MS-ESS3-1),(MS-ESS3-2),(MS-ESS3-3),(MS-ESS3-4),(MS-ESS3-5)

    Activity: Develop a model of the water cycle to explain the quantity of rainfall on different sides of the Rockies.
  - **ELA/Literacy**

    WHST.6-8.7 Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. **(MS-ESS3-3)**

    Activity: Research local impacts of rain/drought on either side of the Rockies.

Eighth Grade
Earth Science
History of Earth

Performance Expectations

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. [Clarification Statement: Emphasis is on how analyses of rock formations and the fossils they contain are used to establish relative ages of major events in Earth's history. Examples of Earth's major events could range from being very recent (such as the last Ice Age or the earliest fossils of homo sapiens) to very old (such as the formation of Earth or the earliest evidence of life). Examples can include the formation of mountain chains and ocean basins, the evolution or extinction of particular living organisms, or significant volcanic eruptions.] [Assessment Boundary: Assessment does not include recalling the names of specific periods or epochs and events within them.]

MS-ESS2-2. Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. [Clarification Statement: Emphasis is on how processes change Earth's surface at time and spatial scales that can be large (such as slow plate motions or the uplift of large mountain ranges) or small (such as rapid landslides or microscopic geochemical reactions), and how many geoscience processes (such as earthquakes, volcanoes, and meteor impacts) usually behave gradually but are punctuated by catastrophic events. Examples of geoscience processes include surface weathering and deposition by the movements of water, ice, and wind. Emphasis is on geoscience processes that shape local geographic features, where appropriate.]

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. [Clarification Statement: Examples of data include similarities of rock and fossil types on different continents, the shapes of the

continents (including continental shelves), and the locations of ocean structures (such as ridges, fracture zones, and trenches).] [Assessment Boundary: Paleomagnetic anomalies in oceanic and continental crust are not assessed.]

Enduring Understandings/Big Ideas:	**Essential Questions:**
• The Earth and the organisms today has gone through many changes over time. • The continents and oceans have changes in 4.6 billion years through fast and slow processes. • Studying earth's artifacts can provide evidence of plate motion.	• How do people figure out that Earth and life on Earth have changed over time? • How does the movement of tectonic plates impact the surface of Earth?

Disciplinary Core Ideas

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. (MS-ESS1- 4)
- Tectonic processes continually generate new ocean sea floor at ridges and destroy old sea floor at trenches. (HS.ESS1.C GBE) (secondary to MS-ESS2-3)

ESS2.A: Earth's Materials and Systems
- 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. (MS-ESS2-2)

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. (MS-ESS2-3)

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. (MS-ESS2-2)

Science and Engineering Practices	**Cross-Cutting Concepts**
Analyzing and Interpreting Data • Analyze and interpret data to provide evidence for phenomena. (MS-ESS2-3) • **Constructing Explanations and Designing Solutions** 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. (MSESS1-4),(MS-ESS2-2)	**Patterns** • Patterns in rates of change and other numerical relationships can provide information about natural systems. (MS-ESS2-3) **Scale Proportion and Quantity** • Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (MS-ESS1- 4),(MS-ESS2-2)

Unit Pacing

Lessons And Timeframe (18 days)

- History of the Planet (2 days)
- Volcanoes, Earthquakes, Meteor Impacts, and Fossils as evidence for changes on Earth (3 days)
- Erosion and deposition (3 days)
- Theory of Plate tectonics with Pangaea and continental drift (10 days)

Interdisciplinary Connections

- **21st Century Skills**
  - **Career Ready Practices**
    - **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.
      CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
      Activity: Analyze and interpret data on the distribution of fossils and rocks to determine relative age of the organism.

  - **9.2 Career Awareness, Exploration, and Preparation**

    - **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
      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.
      9.2.8.B.4 Evaluate how traditional and nontraditional careers have evolved regionally, nationally, and globally.
      Activity: Research how technology has evolved the careers of archaeologists.

- **Technology**
  - **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.
    8.1.8.A.5 Create a database query, sort and create a report and describe the process, and explain the report results.
    Activity: Students will sort fossil data according to rock layer, continent, and/or seafloor structures to explain common ancestry.

- **Core Content Connections**
  - **Science/Math**
    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.
    MP.2 Reason abstractly and quantitatively. (MS-ESS2-2),(MS-ESS2-3),(MS-ESS2-5)
    8.EE.3. Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. How can scientific notation and units of appropriate size be used to represent measurements of very large or very small quantities?
    8.EE.4 Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities
    Activity: Students will analyze the fossil data according to rock layer, continent, and/or seafloor structures to explain common ancestry.
  - **Science/ELA-Literacy**
    SL.8.5 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. **(MS-ESS2-1),(MS-ESS2-2),(MSESS2-6)**
    Activity: Students will create a video to explain their fossil's common ancestry.

Eighth Grade
Life Science
Natural Selection and Adaptations

Performance Expectations
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. [Clarification Statement: Emphasis is on finding patterns of changes in the level of complexity of anatomical structures in organisms and the chronological order of fossil appearance in the rock layers.] [Assessment Boundary: Assessment does not include the names of individual species or geological eras in the fossil record.] **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.** [Clarification Statement: Emphasis is on explanations of the evolutionary relationships among organisms in terms of similarity or differences of the gross appearance of anatomical structures.] **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.** [Clarification Statement: Emphasis is on inferring general patterns of relatedness among embryos of different organisms by comparing the macroscopic appearance of diagrams or pictures.] [Assessment Boundary: Assessment of comparisons is limited to gross appearance of anatomical structures in embryological development.] **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.** [Clarification Statement: Emphasis is on using simple probability statements and proportional reasoning to construct explanations **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.** [Clarification Statement: Emphasis is on using mathematical models, probability statements, and proportional reasoning to support explanations of trends in changes to populations over time.] [Assessment Boundary: Assessment does not include Hardy Weinberg calculations.]

Enduring Understandings/Big Ideas:	Essential Questions:
• Fossils can help determine how life was in the past. • Anatomical similarities can be seen among different organisms on Earth with supports the idea of a common ancestor. • The embryological development shows similarities between vertebrates and supports the idea of a common ancestor. • Look at DNA evidence shows strong similarities between certain organisms that indicate common ancestry. • Phenotypic traits can provide advantages and disadvantages that can affect the success of a population over time.	• How does genetic variation among organisms in a species affect survival and reproduction? • How does the environment influence genetic traits in populations over multiple generations?

Disciplinary Core Ideas
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. (MS-LS4-1)

- 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. (MS-LS4-2)
- Comparison of the embryological development of different species also reveals similarities that show relationships not evident in the fully-formed anatomy. (MS-LS4-3)

LS4.B: Natural Selection

- Natural selection leads to the predominance of certain traits in a population, and the suppression of others. (MS-LS4-4)

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. (MS-LS4-6)

Science and Engineering Practices	Cross-Cutting Concepts
Analyzing and Interpreting Data • Analyze displays of data to identify linear and nonlinear relationships. (MS-LS4-3) • Analyze and interpret data to determine similarities and differences in findings. (MS-LS4-1) **Using Mathematics and Computational Thinking**. • Use mathematical representations to support scientific conclusions and design solutions. (MS-LS4-6) **Constructing Explanations and Designing Solutions** • Apply scientific ideas to construct an explanation for real-world phenomena, examples, or events. (MS-LS4- 2) • Construct an explanation that includes qualitative or quantitative relationships between variables that describe phenomena. (MS-LS4-4)	**Patterns** • Patterns can be used to identify cause and effect relationships. (MS-LS4-2) Graphs, charts, and images can be used to identify patterns in data. (MS-LS4-1), (MS-LS4-3) **Cause and Effect** • Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (MS-LS4-4),(MS-LS4-6)

Unit Pacing

Lessons And Timeframe (12 days)

- Evidence of Evolution to include the following:
  - Fossil Patterns (3 days)
  - Anatomical similarities and differences (2 days)
  - Embryological development (1 day)
  - DNA Evidence (2 days)
- Natural Selection and variation within a population (4 days)

Interdisciplinary Connections

- **21st Century Skills**
  - **Career Ready Practices**

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.
CRP4. Communicate clearly and effectively and with reason.
Activity: Construct an explanation to communicate how genetic variations of traits in the Peppered Moth population increased some individuals' probability of surviving and reproducing.

- **9.2 Career Awareness, Exploration, and Preparation**
  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.
  9.2.8.B.3 Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.
  Activity: As a group, students will analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species.

- **Technology**
  - **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.
    8.1.8.A.2 Create a document (e.g. newsletter, reports, personalized learning plan,business letters or flyers) using one or more digital applications to be critiqued by professionals for usability.
    Activity: Create a travel brochure highlighting the environmental conditions on islands that would best suit two different types of finches.

- **Core Content Connections**
  - **Science/Math**
    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.
    6.RP.A.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. (MS-LS4-4),(MS-LS4-6)
    Activity:Use the peppered moth gizmo to identify ratios of light- and dark-peppered moths each year for 5 years.
  - **Science/ELA-Literacy**
    RST.6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.
    (MS-LS4-3),(MS-LS4-4)
    Activity: Students worked in groups of 3 to read current event articles from one of 3 political perspectives.

Eighth Grade
Earth Science
Weather and Climate

Performance Expectations

MS-ESS2-5. Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions. [Clarification Statement: Emphasis is on how air masses flow from regions of high pressure to low pressure, causing weather (defined by temperature, pressure, humidity, precipitation, and wind) at a fixed location to change over time, and how sudden changes in weather can result when different air masses collide. Emphasis is on how weather can be

predicted within probabilistic ranges. Examples of data can be provided to students (such as weather maps,diagrams, and visualizations) or obtained through laboratory experiments (such as with condensation).] [Assessment Boundary: Assessment does not include recalling the names of cloud types or weather symbols used on weather maps or the reported diagrams from weather stations.]

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. [Clarification Statement: Emphasis is on how patterns vary by latitude, altitude, and geographic land distribution. Emphasis of atmospheric circulation is on the sunlight-driven latitudinal banding, the Coriolis effect, and resulting
prevailing winds; emphasis of ocean circulation is on the transfer of heat by the global ocean convection cycle, which is constrained by the Coriolis effect and the outlines of continents. Examples of models can be diagrams, maps and globes, or digital representations.] [Assessment Boundary: Assessment does not include the dynamics of the Coriolis effect.]

MS-ESS3-5. Ask questions to clarify evidence of the factors that have caused climate change over the past century. [Clarification Statement: Examples of factors include human activities (such as fossil fuel combustion, cement production, and agricultural activity) and natural processes (such as changes in incoming solar radiation or volcanic activity). Examples of evidence can include tables, graphs, and maps of global and regional temperatures, atmospheric levels of gases such as carbon dioxide and methane, and the rates of human activities. Emphasis is on the major role that human activities play in causing the rise in global temperatures.]

Enduring Understandings/Big Ideas:	**Essential Questions:**
• Air masses can result in changes to the daily weather. • Using various types of atmospheric evidence can help predict weather changes. • Human activities such as burning fossil fuels are affecting the global weather and climate patterns.	• What factors interact and influence weather and climate?

Disciplinary Core Ideas

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. (MS-ESS2-5)
- Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents. (MS-ESS2- 6)

ESS2.D: Weather and Climate

- 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. (MS-ESS2-6)
- Because these patterns are so complex, weather can only be predicted probabilistically. (MS-ESS2-5)
- 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. (MS-ESS2-6)

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. (MS-ESS3-*5*)

Science and Engineering Practices	Cross-Cutting Concepts
Asking Questions and Defining Problems • Ask questions to identify and clarify evidence of an argument. (MS-ESS3-*5*) **Developing and Using Models** • Develop and use a model to describe phenomena. (MSESS2-6) **Planning and Carrying Out Investigations** • Collect data to produce data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions. (MS-ESS2-*5*)	**Cause and Effect** • Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-ESS2-*5*) **Systems and System Models** • Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy, matter, and information flows within systems. (MS-ESS2-6) **Stability and Change** • Stability might be disturbed either by sudden events or gradual changes that accumulate over time. (MS-ESS3-*5*)

Unit Pacing

Lessons And Timeframe (20 days)

- Air masses (3 days)
- Pressure systems (2 days)
- Fronts (5 days)
- Factors affecting Climate (5 days)
- Human Activities and Climate Change (5 days)

Interdisciplinary Connections

- **21st Century Skills**
  - **Career Ready Practices**
    - **MS-ESS2-*5***. Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.
      CRPI1. Use technology to enhance productivity.
      Activity: Students use technology from NOAA to collect data to explain how air masses interact and produce changes in weather conditions.
  - **9.2 Career Awareness, Exploration, and Preparation**

    MS-ESS3-*5*. Ask questions to clarify evidence of the factors that have caused climate change over the past century
    9.2.8.B.4 Evaluate how traditional and nontraditional careers have evolved regionally, nationally, and globally.
    Activity: Students research the role of meteorologists have changed, especially with increasing severity of natural disasters due to the rise in global temperatures.

- **Technology**
  - **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.
    8.1.8.A.4 Graph and calculate data within a spreadsheet and present a summary of the results

Activity: Students will research local weather patterns of three locations on the same longitude to present an argument for where someone should go on vacation in July.

- **Core Content Connections**
  - **Science/Math**

    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.NS.C.5 Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation. **(MS-ESS2-5)**

    Activity: Develop a model and write a weather report using positive and negative temperatures and elevations to describe local/regional weather conditions.
  - **Science/ELA-Literacy**

    RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). **(MS-ESS2-3)**

    Activity: Develop a model and write a weather report using positive and negative temperatures and elevations to describe local/regional weather conditions.