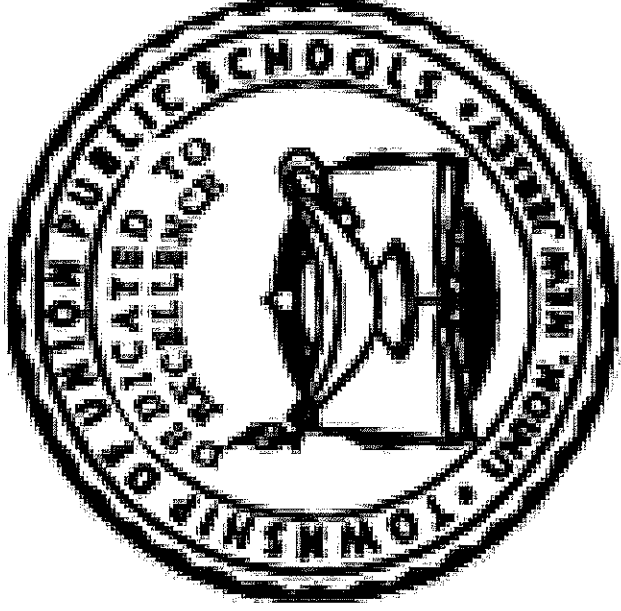


TOWNSHIP OF UNION PUBLIC SCHOOLS



7th Grade Science

Curriculum Guide

July 2018 revised

Mission Statement

The mission of the Township of Union Public Schools is to build on the foundations of honesty, excellence, integrity, strong family, and community partnerships. We promote a supportive learning environment where every student is challenged, inspired, empowered, and respected as diverse learners. Through cultivation of students' intellectual curiosity, skills and knowledge, our students can achieve academically and socially, and contribute as responsible and productive citizens of our global community.

Philosophy Statement

The Township of Union Public School District, as a societal agency, reflects democratic ideals and concepts through its educational practices. It is the belief of the Board of Education that a primary function of the Township of Union Public School System is the formulation of a learning climate conducive to the needs of all students in general, providing therein for individual differences. The school operates as a partner with the home and community.

Science Department Mission

The mission of the **Burnet Science Department** in the Union Township Public School System is to prepare the students to become independent, lifelong learners who think critically, collaborate and persevere. We are determined to inspire our students to hypothesize, explore and investigate using the scientific method integrated with technology. Our vision is to produce a student who has the vision of him/herself as a responsible, enthusiastic, engaged member of the school community.

The goal of the **Kawameeh Middle School Science Department** is to expose students to the different branches of science through the use of labs, modern technology, and field experiences. We aspire to develop scientific literacy in all students, allowing them to utilize problem solving and critical thinking skills. Students are encouraged to reach their highest potential by engaging in inquiry-based activities and experiments. When students develop a deep understanding of science they can truly appreciate the world in which they live.

Science Department Vision

We aspire to encourage creativity and imagination, as it allows students to explore the world around them on their own. Our classrooms are conducive to student learning and our activities are student centered. At Union Township we expect highly of our staff and students and uphold them to high standards. We would like to see students pursue science in college, their career choice, or personal interests.

Statement of District Goals

- **Develop reading, writing, speaking, listening, and mathematical skills.**
- **Develop a pride in work and a feeling of self-worth, self-reliance, and self discipline.**
- **Acquire and use the skills and habits involved in critical and constructive thinking.**
- **Develop a code of behavior based on moral and ethical principals.**
- **Work with others cooperatively.**
- **Acquire a knowledge and appreciation of the historical record of human achievement and failures and current societal issues.**
- **Acquire a knowledge and understanding of the physical and biological sciences.**
- **Participate effectively and efficiently in economic life and the development of skills to enter a specific field of work.**
- **Appreciate and understand literature, art, music, and other cultural activities.**
- **Develop an understanding of the historical and cultural heritage.**
- **Develop a concern for the proper use and/or preservation of natural resources.**
- **Develop basic skills in sports and other forms of recreation.**

Course Description

The seventh grade elaborates upon and deepens the concepts of the spiral of physical, life and earth science. This “spiral of knowledge” engenders the continuity of connections between and among the sciences aforementioned.

During the physical science unit students will learn about the structure and properties of matter, interactions of matter, and chemical reactions.

During the life science unit students will learn about the structure and function of living things, body systems, and the organization of matter and energy flow in organisms.

During the earth science unit students will learn about weather and climate and Earth’s systems.

The seventh grade science curriculum is a link in the chain of knowledge that will allow our students to be empowered, life time learners.

Course Proficiencies- Seventh Grade Science

Unit 1: Structure and Function

- Conduct an investigation to provide evidence that living things are made of cells, either one cell or many different numbers and types of cells. MS-LS1-1
- Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function. MS-LS1-2

Unit 2: Organization for Matter and Energy Flow in Organisms

- 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. MS-LS1-6
- 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. MS-LS1-7

Unit 3: Information Processing

- Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells. MS-LS1-3
- Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories. MS-LS1-8

Unit 4: Structure and Properties of Matter

- Develop models to describe the atomic composition of simple molecules and extended structures. MS-PS1-1
- Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred. MS-PS1-2

Unit 5: Interactions of Matter

- Gather and make sense of information to describe that synthetic materials come from natural resources and impact society. MS-PS1-3
- 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. MS-PS1-4

Unit 6: Chemical Reactions

- 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. MS-PS1-5
- Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes. MS-PS1-6
- 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-ETS1-3

Unit 7: Weather and Climate

- Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity. MS-ESS2-4
- Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions. MS-ESS2-5
- Explain how variations in density result from variations in temperature and salinity drive a global pattern of interconnected ocean currents ESS2.C
- Use a model to explain the mechanisms that cause varying daily temperature ranges in a coastal community and in a community located in the interior of the country. ESS2.C; ESS2.DDevelop 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. MS-ESS2-6

Unit 8: Earth Systems

- 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-ESS1-4
- Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process. MS-ESS2-1
- Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. MS-ESS2-2
- Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions. MS-ESS2-3

Curriculum Units – Seventh Grade Science

- **Unit 1:** Structure and Function
- **Unit 2:** Growth and Development of Organisms
- **Unit 3:** Organization for Matter and Energy Flow in Organisms
- **Unit 4:** Information Processing
- **Unit 5:** Structure and Properties of Matter
- **Unit 6:** Interactions of Matter
- **Unit 7:** Chemical Reactions
- **Unit 8:** Weather and Climate
- **Unit 9:** Earth Systems

Pacing Guide- Seventh Grade Science

Unit 1: Structure and Function

Instructional Days: 15

Students demonstrate age appropriate abilities to plan and carry out investigations to develop *evidence* that living organisms are made of cells. Students gather information to support explanations of the relationship between structure and function in cells. They are able to communicate an understanding of cell theory and understand that all organisms are made of cells. Students understand that special structures are responsible for particular functions in organisms. They then are able to use their understanding of cell theory to develop and use physical and conceptual models of cells. The crosscutting concepts of *scale, proportion, and quantity* and *structure and function* provide a framework for understanding the disciplinary core ideas. Students are expected to demonstrate proficiency in *planning and carrying out investigations, analyzing and interpreting data*, and *developing and using models*. Students are also expected to use these to use these science and engineering practices to demonstrate understanding of the disciplinary core ideas.

This unit is based on MS-LS1-1 and MS-LS1-2.

Unit 2: Growth and Development of Organisms

Instructional Days: 25

Students use data and conceptual models to understand how the environment and genetic factors determine the growth of an individual organism. They connect this idea to the role of animal behaviors in animal reproduction and to the dependence of some plants on animal behaviors for their reproduction. Students provide evidence to support their understanding of the structures and behaviors that increase the likelihood of successful reproduction by organisms. The crosscutting concepts of *cause and effect* and *structure and function* provide a framework for understanding the disciplinary core ideas. Students demonstrate grade-appropriate proficiency in *analyzing and interpreting data, using models, conducting investigations*, and *communicating information*. Students are also expected to use these practices to demonstrate understanding of the core ideas.

This unit is based on MS-LS1-4 and MS-LS1-5.

Unit 3: Organization for Matter and Energy Flow in Organisms

Instructional Days: 15

Students provide a mechanistic account for how cells provide a structure for the plant process of photosynthesis in the movement of matter and energy needed for the cell. Students use conceptual and physical models to explain the transfer of energy and cycling of matter as they construct explanations for the role of photosynthesis in cycling matter in ecosystems. They construct scientific explanations for the cycling of matter in organisms and the interactions of organisms to obtain matter and energy from an ecosystem to survive and grow. They understand that sustaining life requires substantial energy and matter inputs, and that the structure and functions of organisms contribute to the capture, transformation, transport, release, and elimination of matter and energy. The crosscutting concepts of *matter and energy* and *structure and function* provide a framework for

understanding of the cycling of matter and energy flow into and out of organisms. Students are also expected to demonstrate proficiency in *developing and using models*. Students use these science and engineering practices to demonstrate understanding of the disciplinary core ideas.

This unit is based on MS-LS1-6 and MS-LS1-7.

Unit 4: Information Processing

Instructional Days: 15

Students develop a basic understanding of the role of cells in body systems and how those systems work to support the life functions of the organism. Students will construct explanations for the interactions of systems in cells and organisms. Students understand that special structures are responsible for particular functions in organisms, and that for many organisms, the body is a system of multiple-interaction subsystems that form a hierarchy, from cells to the body. Students construct explanations for the interactions of systems in cells and organisms and for how organisms gather and use information from the environment. The crosscuttings concepts of *systems and system models* and *cause and effect* provide a framework for understanding the disciplinary core ideas. Students are expected to demonstrate proficiency in *engaging in argument from evidence* and *obtaining, evaluating, and communicating information*. Students use these science and engineering practices to demonstrate understanding of the disciplinary core ideas.

This unit is based on MS-LS1-3 and MS-LS1-8.

Unit 5: Structure and Properties of Matter

Instructional Days: 15

Students build understandings of what occurs at the atomic and molecular scale. Students apply their understanding that pure substances have characteristic properties and are made from a single type of atom or molecule. They also provide a molecular level accounts to explain states of matter and changes between states. The crosscutting concepts of *cause and effect*, *scale*, *proportion and quantity*, *structure and function*, *interdependence of science, engineering, and technology*, and *the influence of science, engineering and technology on society and the natural world* provide a framework for understanding the disciplinary core ideas. Students demonstrate grade appropriate proficiency in *developing and using models*, and *obtaining, evaluating, and communicating information*. Students are also expected to use the scientific and engineering practices to demonstrate understanding of the core ideas.

This unit is based on MS-PS1-1 and MS-PS1-2.

Unit 6: Interactions of Matter

Instructional Days: 15

Students provide molecular-level accounts of states of matter and changes between states, of how chemical reactions involve regrouping of atoms to form new substances, and of how atoms rearrange during chemical reactions. Students are also able to apply an understanding of optimization design and process in engineering to chemical reaction systems. The crosscutting concepts of *structure and function*, *cause and effect*, *interdependence of science, engineering, and technology*, and *influence of science, engineering, and technology on society and on the natural world* provide a framework for understanding the disciplinary core ideas. Students are expected to demonstrate grade appropriate proficiency in *obtaining, evaluating, and communicating information* and *developing and using models*. Students are also expected to use the scientific and engineering practices to demonstrate understanding of the core ideas.

This unit is based on MS-PS1-3 and MS-PS1-4.

Unit 7: Chemical Reactions

Instructional Days: 30

Students provide molecular-level accounts of states of matters and changes between states, of how chemical reactions involve regrouping of atoms to form new substances, and of how atoms rearrange during chemical reactions. Students also apply their understanding of optimization design and process in engineering to chemical reaction systems. The crosscutting concept of *energy and matter* provides a framework for understanding the disciplinary core ideas. Students are expected to demonstrate proficiency in *developing and using models*, *analyzing and interpreting data*, *designing solutions*, and *obtaining, evaluating, and communicating information*. Students are also expected to use these science and engineering practices to demonstrate understanding of the disciplinary core ideas.

This unit is based on MS-PS1-5, MS-PS1-6, MS-ETS1-2, MS-ETS1-3, and MS-ETS1-4.

Unit 8: Weather and Climate

Instructional Days: 20

This unit is broken down into three sub-ideas: Earth's large-scale systems interactions, the roles of water in Earth's surface processes, and weather and climate. Students make sense of how Earth's geosystems operate by modeling the flow of energy and cycling of matter within and among different systems. A systems approach is also important here, examining the feedbacks between systems as energy from the Sun is transferred between systems and circulates through the ocean and atmosphere. The crosscutting concepts of *cause and effect*, *systems and system models*, and *energy and matter* are called out as frameworks for understanding the disciplinary core ideas. In this unit, students are expected to demonstrate proficiency in *developing and using models* and *planning and carrying out investigations* as they make sense of the disciplinary core ideas. Students are also expected to use these practices to demonstrate understanding of the core ideas.

This unit is based on MS-ESS2-4, MS-ESS2-5, and MS-ESS2-6.

Unit 9: Earth Systems

Instructional Days: 30

Students examine geoscience data in order to understand processes and events in Earth's history. Important crosscutting concepts in this unit are *scale, proportion, and quantity*, *stability and change*, and *patterns* in relation to the different ways geologic processes operate over geologic time. An important aspect of the history of Earth is that geologic events and conditions have affected the evolution of life, but different life forms have also played important roles in altering Earth's systems. Students understand how Earth's geosystems operate by modeling the flow of energy and cycling of matter within and among different systems. Students investigate the controlling properties of important materials and construct explanations based on the analysis of real geoscience data. Students are expected to demonstrate proficiency in *analyzing and interpreting data* and *constructing explanations*. They are also expected to use these practices to demonstrate understanding of the core ideas.

This unit is based on MS-ESS1-4, MS-ESS2-1, MS-ESS2-2, and MS-ESS2-3.

Unit 1: Structure and Function

Unit Summary	
How do cells contribute to the functioning of an organism?	
<p>Students demonstrate age appropriate abilities to plan and carry out investigations to develop evidence that living organisms are made of cells. Students gather information to support explanations of the relationship between structure and function in cells. They are able to communicate an understanding of cell theory and understand that all organisms are made of cells. Students understand that special structures are responsible for particular functions in organisms. They then are able to use their understanding of cell theory to develop and use physical and conceptual models of cells. The crosscutting concepts of <i>scale, proportion, and quantity</i> and <i>structure and function</i> provide a framework for understanding the disciplinary core ideas. Students are expected to demonstrate proficiency in <i>planning and carrying out investigations, analyzing and interpreting data, and developing and using models</i>. Students are also expected to use these to use these science and engineering practices to demonstrate understanding of the disciplinary core ideas.</p>	
Student Learning Objectives	
<p>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: <i>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.</i>] (MS-LS1-1)</p>	
<p>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: <i>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.</i>] [Assessment Boundary: <i>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.</i>] (MS-LS1-2)</p>	
Unit Sequence	
<p>Part A: How will astrobiologists know if they have found life elsewhere in the solar system?</p>	
Concepts	Formative Assessment
<ul style="list-style-type: none"> • Distinguish between living and nonliving things. • Cells are the smallest unit of life that can be said to be alive. • All living things are made up of cells, either one cell or many different numbers and types of cells. 	<p><i>Students who understand the concepts are able to:</i></p> <ul style="list-style-type: none"> • Conduct an investigation to produce data that provides evidence distinguishing between living and nonliving things. • Conduct an investigation to produce data supporting the concept that

<ul style="list-style-type: none"> • Organisms may consist of one single cell (unicellular). • Nonliving things can be composed of cells. • Organisms may consist of many different numbers and types of cells (multicellular). • Cells that can be observed at one scale may not be observable at another scale. • Engineering advances have led to important discoveries in the field of cell • biology, and scientific discoveries have led to the development of entire industries and engineered systems. 	<p>living things may be made of one cell or many and varied cells.</p> <ul style="list-style-type: none"> • Distinguish between living and nonliving things. • Observe different types of cells that can be found in the makeup of living things.
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Unit Sequence	
Part B: How do the functions of cells support an entire organism?	
Concepts	Formative Assessment
<ul style="list-style-type: none"> • The cell functions as a whole system. • Identify parts of the cell, specifically the nucleus, chloroplasts, mitochondria, cell membrane, and cell wall. • Within cells, special structures are responsible for particular functions. • Within cells, the cell membrane forms the boundary that controls what enters and leaves the cell. • Complex and microscopic structures and systems in cells can be visualized, modeled, and used to describe how the function of the cell depends on the relationships among its parts. • Complex natural structures/systems can be analyzed to determine how they function. • A model can be used to describe the function of a cell as a whole. • A model can be used to describe how parts of cells contribute to the cell's function. • The structures of the cell wall and cell membrane are related to their function. 	<p><i>Students who understand the concepts are able to:</i></p> <ul style="list-style-type: none"> • Develop and use a model to describe the function of a cell as a whole. • Develop and use a model to describe how parts of cells contribute to the cell's function. • Develop and use models to describe the relationship between the structure and function of the cell wall and cell membrane.

Connections to Other Units

Grade 6 Unit 6: Inheritance and Variation 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.
- Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited.
- 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.
- 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.

Grade 7 Unit 8: Earth 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.
- 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.

Appendix A: NGSS and Foundations for the Unit

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-LS1-1)

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-LS1-2)

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Disciplinary Core Ideas

Crosscutting Concepts

<p>Planning and Carrying Out Investigations</p> <ul style="list-style-type: none"> Conduct an investigation to produce data to serve as the basis for evidence that meet the goals of an investigation. (MS-LS1-1) <p>Developing and Using Models</p> <ul style="list-style-type: none"> Develop a model to describe phenomena. (MS-LS1-2) 	<p>LS1.A: Structure and Function</p> <ul style="list-style-type: none"> 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) 	<p>Scale, Proportion, and Quantity</p> <ul style="list-style-type: none"> Phenomena that can be observed at one scale may not be observable at another scale. (MS-LS1-1) <p>Structure and Function</p> <ul style="list-style-type: none"> 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) <p>-----</p> <p>Connections to Engineering, Technology and Applications of Science</p> <p>Interdependence of Science, Engineering, and Technology</p> <ul style="list-style-type: none"> 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-LS1-1)
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<p>English Language Arts</p> <p>Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating</p>	<p>Mathematics</p> <p>Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one</p>
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additional related, focused questions that allow for multiple avenues of exploration. (MS-LS1-1) **WHST.6-8.7**

Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-LS1-2) **SL.8.5**

quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. (MS-LS1-1),(MS-LS1-2) **6.EE.C.9**

Unit 1: Structure and Function (15 days)			
This unit is based on:	SLO	Inquiry Menu	Quick Links
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.	<ol style="list-style-type: none"> 1. Microscope Mania (Day 1) 2. Microscope Mania (Day 2) 3. Cells the basic building blocks of Living Things 4. Eukaryotes & prokaryotes- Similarities and differences 	<ol style="list-style-type: none"> 1. http://betterlesson.com/lesson/638282/microscope-mania-part-1- 2. http://betterlesson.com/lesson/639744/microscope-mania-day-part-2-2 3. http://betterlesson.com/next_gen_science/browse/2216/ngss-ms-ls1-1-conduct-an-investigation-to-provide-evidence-that-living-things-are-made-of-cells-either-one-cell-or-many-different
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.	<ol style="list-style-type: none"> 5. Cells to Tissues to Organs 6. Insane in the membrane 7. The Incredible edible cell 	<ol style="list-style-type: none"> 4. http://betterlesson.com/lesson/626286/eukaryotes-and-prokaryotes-similarities-and-differences 5. http://betterlesson.com/lesson/632404/cells-to-tissues-to-organs 6. http://betterlesson.com/lesson/638622/insane-in-the-membrane 7. http://betterlesson.com/lesson/638284/the-incredible-edible-cell

1. Students are introduced to Cell Theory as they read text through the lens of the NGSS Crosscutting Concepts in order to make deep connections and generate questions they have surrounding the content. Then, students look at living and nonliving things under microscopes. **This lesson is specifically designed to meet the following NGSS: 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.
2. On Day 2 of this lesson, students support claims with evidence as they write a scientific argument. **This lesson is specifically designed to meet the following NGSS: 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.
3. The purpose of this activity is to **engage** students in a new concept (cell biology) through the use of an animation to promote curiosity, generate enthusiasm and elicit prior knowledge. **This lesson is specifically designed to meet the following NGSS: 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.
4. In the first 5 minutes of class students read an article that discusses about the benefit of a "wimpy" handshake. This lesson follows a lesson that introduces students to prokaryotes and its most famous example, bacteria. The rationale for using this article, besides its interesting topic (rate of bacteria transfer depending on type of handshake), is that it connects the previous lesson to today's lesson. In addition, it's an article that everyone can relate to since handshaking is a daily occurrence for most people. **This lesson is specifically designed to meet the following NGSS: 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.
5. In this lesson use pieces of wooden train track are used as a visual for students. Alternatively, you could use Legos or K'NEX to build a house, beads and pieces of string to create a necklace or a small puzzle. The purpose is to illustrate how to use the different pieces to go from single cell to a class "organism". The manipulative aspect of this lesson is important for students to be able to develop a conceptual model to represent and understand the concept being taught (SP2). **This lesson is specifically designed to meet the following NGSS: MS-LS1-1**
1 Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.
6. In this lesson, students use reading strategies to learn about the structure and function relationship in the cell membrane as they create a model of membranes using soap bubbles. This lesson is specifically designed to address the following: 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.
7. In this lesson, students create a model of a cell using candy as they connect the structure of the candy to the structure and function of cell organelles. This lesson is specifically designed to address the following NGSS: 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.

Unit 2: Growth and Development of Organisms

Unit Summary

What influences the growth and development of an organism?

Students use data and conceptual models to understand how the environment and genetic factors determine the growth of an individual organism. They connect this idea to the role of animal behaviors in animal reproduction and to the dependence of some plants on animal behaviors for their reproduction. Students provide evidence to support their understanding of the structures and behaviors that increase the likelihood of successful reproduction by organisms. The crosscutting concepts of *cause and effect* and *structure and function* provide a framework for understanding the disciplinary core ideas. Students demonstrate grade-appropriate proficiency in *analyzing and interpreting data*, *using models*, *conducting investigations*, and *communicating information*. Students are also expected to use these practices to demonstrate understanding of the core ideas.

This unit is based on MS-LS1-4 and MS-LS1-5.

Student Learning Objectives

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-LS1-4)

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-LS1-5)

Unit Sequence	
Part A: How do characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants, respectively?	
Concepts	Formative Assessment
<ul style="list-style-type: none"> Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction. ✓ There are a variety of ways that plants reproduce. Specialized structures for plants affect their probability of successful reproduction. Some characteristic animal behaviors affect the probability of successful reproduction in plants. Animals engage in characteristic behaviors that affect the probability of successful reproduction. There are a variety of characteristic animal behaviors that affect their probability of successful reproduction. There are a variety of animal behaviors that attract a mate. Successful reproduction of animals and plants may have more than one cause, and some cause-and-effect relationships in systems can only be described using probability. 	<p><i>Students who understand the concepts are able to:</i></p> <ul style="list-style-type: none"> Collect empirical evidence about animal behaviors that affect the animals' probability of successful reproduction and also affect the probability of plant reproduction. Collect empirical evidence about plant structures that are specialized for reproductive success. Use empirical evidence from experiments and other scientific reasoning to support oral and written arguments that explain the relationship among plant structure, animal behavior, and the reproductive success of plants. Identify and describe possible cause-and effect relationships affecting the reproductive success of plants and animals using probability. Support or refute an explanation of how characteristic animal behaviors and specialized plant structures affect the probability of successful plant reproduction using oral and written arguments.

Unit Sequence	
Part B: How do environmental and genetic factors influence the growth of organisms?	
Concepts	Formative Assessment
<ul style="list-style-type: none"> Genetic factors as well as local conditions affect the growth of organisms. ✓ A variety of local environmental conditions affect the growth of organisms. Genetic factors affect the growth of organisms (plant and animal). 	<p><i>Students who understand the concepts are able to:</i></p> <ul style="list-style-type: none"> Conduct experiments, collect evidence, and analyze empirical data. Use evidence from experiments and other scientific reasoning to support oral and written explanations of how environmental and genetic factors influence the growth of organisms.

- The factors that influence the growth of organisms may have more than one cause.
- Some cause-and-effect relationships in plant and animal systems can only be described using probability.

- Identify and describe possible causes and effects of local environmental conditions on the growth of organisms.
- Identify and describe possible causes and effects of genetic conditions on the growth of organisms.

Three-Dimensional Teaching and Learning

Instruction should result in students being able to use arguments based on empirical evidence and scientific reasoning to support an explanation of how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants. Students may observe examples of plant structures that could affect the probability of plant reproduction, including bright flowers attracting butterflies that transfer pollen, flower nectar and odors that attract pollen-transferring insects, and hard shells on nuts that squirrels bury. Possible activities could include plant experiments (e.g., students could count the number of butterflies on brightly colored plants vs. the number of butterflies on other types of plants and record the data they collect in a table), using microscopes/magnifiers to view plant structures (e.g., dissecting a lily), going on field trips, both virtual and actual (e.g., butterfly garden/botanical garden).

Students may observe examples of animal behaviors that affect the probability of plant reproduction, which could include observing how animals can transfer pollen or seeds and how animals can create conditions for seed germination and growth (e.g., students may conduct an experiment using rapid cycling *Brassica rapa* [Fast Plant] and collect data on how many plants produce seeds with and without the aid of a pollinator).

Students could then observe examples of animal behaviors (using videos, Internet resources, books, etc.) that could affect the probability of successful animal reproduction. These behaviors could include nest building to protect young from cold, herding of animals to protect young from predators, and colorful plumage and vocalizations to attract mates for breeding. Students may be able to identify and describe possible cause-and-effect relationships in factors that contribute to the reproductive success of plants and animals by using probability data from the rapid-cycling *Brassica rapa* (Fast Plant) experiments and drawing conclusions about one relationship between animals and plants.

At this point, students can present an oral and/or written argument supported by evidence and scientific reasoning that characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants, respectively. Students may use evidence from experiments or other sources to identify the role of pollinators in plant reproduction.

Instruction that results in students being able to construct an evidence-based scientific explanation for how environmental and genetic factors influence the growth of organisms could begin with students conducting experiments and collecting data on the environmental conditions that effect the growth of organisms (e.g., the effect of variables such as food, light, space, and water on plant growth).

Students could then examine genetic factors (inherited traits) that influence the growth of organisms, including parental traits and selective breeding. *It is important to note that at this grade level, Mendelian genetics are not a part of student learning. Mendelian genetics will be covered in future grades.* This unit of study could end with students using an oral and/or written argument, supported by evidence and scientific reasoning from their

experiments, to explain how environmental conditions and genetic factors affect the growth of an organism.

Connections to Other Units

Grade 6 Unit 3: Matter and Energy in Organisms and 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)
- 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)

Appendix A: NGSS and Foundations for the Unit

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-LS1-4)

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-LS1-5)

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p>Engaging in Argument from Evidence</p> <ul style="list-style-type: none"> 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) <p>Constructing Explanations and Designing Solutions</p> <ul style="list-style-type: none"> 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 	<p>LS1.B: Growth and Development of Organisms</p> <ul style="list-style-type: none"> 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) 	<p>Cause and Effect</p> <ul style="list-style-type: none"> Cause and effect relationships may be used to predict phenomena in natural systems. (MS-LS1-4),(MS-LS1-5) 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) <p>Structure and Function</p> <ul style="list-style-type: none"> Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the relationships among its

and will continue to do so in the future. (MS-LS1-5)		parts; therefore complex natural structures/systems can be analyzed to determine how they function. (MS-LS1-4), (MS-LS1-5)
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English Language Arts	Mathematics
<p>Cite specific textual evidence to support analysis of science and technical texts. (MS-LS1-4),(MS-LS1-5) RST.6-8.1</p> <p>Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions. (MS-LS1-5) RST.6-8.2</p> <p>Trace and evaluate the argument and specific claims in a text, distinguishing claims that are supported by reasons and evidence from claims that are not. (MS-LS1-4) RI.6.8</p> <p>Write arguments focused on discipline content. (MS-LS1-4) WHST.6-8.1</p> <p>Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (MS-LS1-5) WHST.6-8.2</p> <p>Draw evidence from informational texts to support analysis, reflection, and research. (MS-LS1-5) WHST.6-8.9</p>	<p>Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape. (MS-LS1-4),(MS-LS1-5) 6.SP.A.2</p> <p>Summarize numerical data sets in relation to their context. (MS-LS1-4),(MS-LS1-5) 6.SP.B.4</p>

Unit 2: Growth and Development of Organisms (25 days)			
This unit is based on:	SLO	STEM	Quick Links
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.	<ol style="list-style-type: none"> 1. Attachment 2. Attachment 3. Attachment 4. Attachment 	https://njctl.org/courses/science/7th-grade-science/growth-and-development-of-organisms/
MS-LS1-5	Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms	<ol style="list-style-type: none"> 1. Vegetative Propagation 2. Animal Behavior Activity 3. Pollen Observations Lab 4. Flower Dissection Lab 	

1. By completing this activity students learn about vegetative reproduction. Students grow new individual plants from a root, stem, or leaf. This helps students understand the different ways in which plants grow and why it is important to have more than one way.

2. Students watch a brief video clip about sea turtles and it helps students understand the various precautions sea turtles take to ensure the safety for their eggs. Students also identify factors which could affect the sea turtle; for example, tourism.

3. This lab illustrates to students how plants get pollen to their ovules. The students complete various drawings and then compare them. Students apply this lab to real life and explain how pollen could be used to identify the type of plant and how pollen from specific plants may trigger seasonal allergies for some individuals.

4. In this lab students dissect a flower to learn about the parts of the plants and they identify what is necessary for successful reproduction; for example, the color of the flower needs to be bright that attracts pollinators such as bees. The petals are very wide allowing pollinators to get to the pollen.

Unit 3: Organization for Matter and Energy Flow in Organisms

Unit Summary	
How do some organisms turn electromagnetic radiation into matter and energy?	
<p>Students provide a mechanistic account for how cells provide a structure for the plant process of photosynthesis in the movement of matter and energy needed for the cell. Students use conceptual and physical models to explain the transfer of energy and cycling of matter as they construct explanations for the role of photosynthesis in cycling matter in ecosystems. They construct scientific explanations for the cycling of matter in organisms and the interactions of organisms to obtain matter and energy from an ecosystem to survive and grow. They understand that sustaining life requires substantial energy and matter inputs, and that the structure and functions of organisms contribute to the capture, transformation, transport, release, and elimination of matter and energy. The crosscutting concepts of <i>matter and energy</i> and <i>structure and function</i> provide a framework for understanding of the cycling of matter and energy flow into and out of organisms. Students are also expected to demonstrate proficiency in <i>developing and using models</i>. Students use these science and engineering practices to demonstrate understanding of the disciplinary core ideas.</p>	
Student Learning Objectives	
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: <i>Emphasis is on tracing movement of matter and flow of energy.</i>] [Assessment Boundary: <i>Assessment does not include the biochemical mechanisms of photosynthesis.</i>] (MS-LS1-6)	
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: <i>Emphasis is on describing that molecules are broken apart and put back together and that in this process, energy is released.</i>] [Assessment Boundary: <i>Assessment does not include details of the chemical reactions for photosynthesis or respiration.</i>] (MS-LS1-7)	
Unit Sequence	
Part A: What is the role of photosynthesis in the cycling of matter and flow of energy into and out of an organism?	
Concepts	Formative Assessment
<ul style="list-style-type: none">Photosynthesis has a role in the cycling of matter and flow of energy into and out of organisms.	<p>Students who understand the concepts are able to:</p>

<ul style="list-style-type: none"> • The flow of energy and cycling of matter can be traced. • 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. • 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. • Sugars produced by plants can be used immediately or stored for growth or later use. • Within a natural system, the transfer of energy drives the motion and/or cycling of matter. 	<ul style="list-style-type: none"> • Construct a scientific explanation for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms based on valid and reliable evidence obtained from sources (including the students' own experiments). • Construct a scientific explanation for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms based on 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.
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Unit Sequence

Part B: How is food rearranged through chemical reactions to form new molecules that support growth and/or release energy as this matter moves through an organism?

Concepts

- Food is rearranged through chemical reactions, forming new molecules that support growth.
- Food is rearranged through chemical reactions, forming new molecules that release energy as this matter moves through an organism.
- Molecules are broken apart and put back together to form new substances, and in this process, energy is released.
- Cellular respiration in plants and animals involves chemical reactions with oxygen that release stored energy.
- In cellular respiration, complex molecules containing carbon react with oxygen to produce carbon dioxide and other materials.
- 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.
- Matter is conserved during cellular respiration because atoms are

Formative Assessment

Students who understand the concepts are able to:

- Develop and use a model to describe how food is rearranged through chemical reactions.

conserved in physical and chemical processes.

Connections to Other Units

Grade 7 Unit 7: 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.
- The total number of each type of atom is conserved, and thus the mass does not change.
- Some chemical reactions release energy, others store energy.

Grade 7 Unit 1: Structure and Function

- Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell.

Grade 7 Unit 9: Earth 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.
- 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.

Appendix A: NGSS and Foundations for the Unit

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-LS1-6)

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-LS1-7)

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education: Science and Engineering Practices*

Disciplinary Core Ideas

Crosscutting Concepts

<p>Constructing Explanations and Designing Solutions</p> <ul style="list-style-type: none"> 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) <p>Developing and Using Models</p> <ul style="list-style-type: none"> Use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-LS1-7) 	<p>LS1.C: Organization for Matter and Energy Flow in Organisms</p> <ul style="list-style-type: none"> 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) <p>PSS.D: Energy in Chemical Processes and Everyday Life</p> <ul style="list-style-type: none"> 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) 	<p>Energy and Matter</p> <ul style="list-style-type: none"> Within a natural system, the transfer of energy drives the motion and/or cycling of matter. (MS-LS1-6) Matter is conserved because atoms are conserved in physical and chemical processes. (MS-LS1-7) <p>-----</p> <p>Connections to Nature of Science</p> <p>Scientific Knowledge is Based on Empirical Evidence</p> <p>Science knowledge is based upon logical connections between evidence and explanations. (MS-LS1-6)</p>
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<p>Cite specific textual evidence to support analysis of science and technical texts. (MS-LS1-6) RST.6-8.1</p> <p>Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions. (MS-LS1-6) RST.6-8.2</p> <p>Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (MS-LS1-6) WHST.6-8.2</p> <p>Draw evidence from informational texts to support analysis, reflection, and research. (MS-LS1-6) WHST.6-8.9</p>	<p>Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. (MS-LS1-6) 6.EE.C.9</p>
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Unit 3: Organization for Matter and Energy Flow in Organisms (15 days)			
This unit is based on:	SLO	STEM	Quick Links
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.	<ol style="list-style-type: none"> 1. Photosynthesis - Plants' Greatest Gift 2. Photosynthesis Lab 	<ol style="list-style-type: none"> 1. http://betterlesson.com/lesson/628232/photosynthesis-plants-greatest-gift 2. http://peterhuntstемarin.weebly.com/photosynthesis-lab.html
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.	<ol style="list-style-type: none"> 3. Cellular Respiration: Do Plants Breathe? 4. Eggcellent Experiment 	<ol style="list-style-type: none"> 3. http://betterlesson.com/lesson/638286/cellular-respiration-do-plants-breathe 4. http://betterlesson.com/lesson/638287/eggcellent-experiment

1. This lesson provided two helpful video clips to help students understand the reactants and products of photosynthesis and also contains instructions for teachers to conduct a “Starch Test” on a plant. The students observe a plant placed in complete darkness and how it loses its color because it can no longer undergo photosynthesis.
2. For this lab students experiment with various colored cellophane and light to see if the colors of light and its intensity affects the photosynthesis process.
3. Students set up a control experiment in which they test to see if Cellular Respiration actually occurs. In this experiment a control is set up with fake peas (plastic beads) and actual peas in a closed jar with some Bromothymol blue solution placed in a test tube. The students record their data for a period of a few days and realize that the Bromothymol blue solution turned yellow due to the gas exchange taking place with the **actual peas**.
4. Students observe active/passive diffusion take place by observing an egg. Prior to beginning the experiment the teacher will submerge the eggs in vinegar and afterwards let the students peel off the shell. The students then place the egg in different liquids (corn syrup, colored water, and regular water) each day to observe diffusion.

Unit 4: Information Processing

Unit Summary

What are humans made of?

Students develop a basic understanding of the role of cells in body systems and how those systems work to support the life functions of the organism. Students will construct explanations for the interactions of systems in cells and organisms. Students understand that special structures are responsible for particular functions in organisms, and that for many organisms, the body is a system of multiple-interaction subsystems that form a hierarchy, from cells to the body. Students construct explanations for the interactions of systems in cells and organisms and for how organisms gather and use information from the environment. The crosscuttings concepts of *systems and system models* and *cause and effect* provide a framework for understanding the disciplinary core ideas. Students are expected to demonstrate proficiency in *engaging in argument from evidence* and *obtaining, evaluating, and communicating information*. Students use these science and engineering practices to demonstrate understanding of the disciplinary core ideas.

Student Learning Objectives

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-LS1-3)	
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.] (MS-LS1-8)	
Unit Sequence	
Part A: What is the evidence that a body is actually a system of interacting subsystems composed of groups of interacting cells?	
Concepts <ul style="list-style-type: none"> • In multicellular organisms, the body is a system of multiple, interacting subsystems. • Subsystems are groups of cells that work together to form tissues. • Organs are groups of tissues that work together to perform a particular body function. • Tissues and organs are specialized for particular body functions. • Systems may interact with other systems. • Systems may have subsystems and be part of larger complex systems. • Interactions are limited to the circulatory, excretory, digestive, respiratory, muscular, and nervous systems. • Scientists and engineers are guided by habits of mind such as intellectual honesty, tolerance of ambiguity, skepticism, and openness to new ideas. 	Formative Assessment <p><i>Students who understand the concepts are able to:</i></p> <ul style="list-style-type: none"> • Use an oral and written argument supported by evidence to support or refute an explanation or a model of how the body is a system of interacting subsystems composed of groups of cells.
Unit Sequence	
Part B: How do organisms receive and respond to information from their environment?	
Concepts <ul style="list-style-type: none"> • Sense receptors respond to different inputs (electromagnetic, mechanical, chemical). • Sense receptors transmit responses as signals that travel along nerve cells to the brain. • Signals are then processed in the brain. • Brain processing results in immediate behaviors or memories. 	Formative Assessment <p><i>Students who understand the concepts are able to:</i></p> <ul style="list-style-type: none"> • Gather, read, and synthesize information from multiple appropriate sources about sensory receptors' response to stimuli. • Assess the credibility, accuracy, and possible bias of each publication and methods used. • Describe how publications and methods used are supported or not

- Cause-and-effect relationships may be used to predict response to stimuli in natural systems.

supported by evidence.

Connections to Other Units

Grade 7 Unit 1: 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).
- Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell.

Grade 6 Unit 4: Inheritance and Variation 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.
- Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited.
- 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.
- 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.

Appendix A: NGSS and Foundations for the Unit

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-LS1-3)**

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.] (MS-LS1-8)

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p>Obtaining, Evaluating, and Communicating Information</p> <ul style="list-style-type: none"> 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) <p>Engaging in Argument from Evidence</p> <ul style="list-style-type: none"> Use an oral and written argument supported by evidence to support or refute an explanation or a model for a phenomenon. (MS-LS1-3) 	<p>LS1.A: Structure and Function</p> <ul style="list-style-type: none"> 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) <p>LS1.D: Information Processing</p> <ul style="list-style-type: none"> 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) 	<p>Systems and System Models</p> <ul style="list-style-type: none"> Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems. (MS-LS1-3) <p>Cause and Effect</p> <ul style="list-style-type: none"> Cause and effect relationships may be used to predict phenomena in natural systems. (MS-LS1-8) <p>-----</p> <p>Connections to Nature of Science</p> <p>Science is a Human Endeavor</p> <ul style="list-style-type: none"> Scientists and engineers are guided by habits of mind such as intellectual honesty, tolerance of ambiguity, skepticism, and openness to new ideas. (MS-LS1-3)

English Language Arts	Mathematics
<p>Cite specific textual evidence to support analysis of science and technical texts. (MS-LS1-3) RST.6-8.1</p> <p>Trace and evaluate the argument and specific claims in a text, distinguishing claims that are supported by reasons and evidence from claims that are not. (MS-LS1-3) RI.6.8</p>	<p>N/A</p>

Write arguments focused on discipline content. (MS-LS1-3) **WHST.6-8.1**

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. (MS-LS1-8) **WHST.6-8.8**

Unit 4: Information Processing (15 days)

This unit is based on:	SLO	STEM	Quick Links
MS-LS1-3	Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells	<ol style="list-style-type: none"> 1. Cells to tissues to organs 2. The Organization of living Things: Structure/Function Relationships 	<ol style="list-style-type: none"> 1. http://betterlesson.com/lesson/632404/cells-to-tissues-to-organs 2. http://betterlesson.com/lesson/638623/the-organization-of-living-things-structure-function-relationships
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	<ol style="list-style-type: none"> 3. A Difference of Mind 4. Lets Talk-Introduction to Neurotransmission 	<ol style="list-style-type: none"> 3. http://betterlesson.com/lesson/629170/a-difference-of-mind 4. http://betterlesson.com/lesson/631867/lets-talk-introduction-to-neurotransmission

1. Cells to Tissues to Organs: Students are able to relate single cells to tissues to organs to organ systems to organisms by creating an analogy using a model train (K'NEX or Legos to build a house could be substituted). Students will understand that body systems are made of tiny parts working together. (Standards: MS-LS1-1, MS-LS1-2, MS-LS1-3)
2. The Organization of living Things: Structure/Function Relationships: students research to identify the structure/function relationships that occur in cells, tissues, and organs. Students learn about how cells are grouped in living organisms and are introduced to how to determine if a website is a credible resource. (Standards: MS-LS1-3)

3. A Difference of Mind: Students work through a variety of stations to determine that there is a large variation in how different brains respond to situations/stimuli. (Standards: MS-LS1-8)
4. Lets Talk-Introduction to Neurotransmission: Students explore neurotransmission through a variety of activities including a kinesthetic model. Students create a large neuron and after learning the different parts have to put it together correctly. (Standards: MS-LS-1-2, MS-LS1-8)

Unit 5: Structure and Properties of Matter

Unit Summary

How is it that everything is made of star dust?

Students build understandings of what occurs at the atomic and molecular scale. Students apply their understanding that pure substances have characteristic properties and are made from a single type of atom or molecule. They also provide a molecular level accounts to explain states of matter and changes between states. The crosscutting concepts of *cause and effect*, *scale, proportion and quantity*, *structure and function*, *interdependence of science, engineering, and technology*, and *the influence of science, engineering and technology on society and the natural world* provide a framework for understanding the disciplinary core ideas. Students demonstrate grade appropriate proficiency in *developing and using models*, and *obtaining, evaluating, and communicating information*. Students are also expected to use the scientific and engineering practices to demonstrate understanding of the core ideas.

Student Learning Objectives

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. The substructure of atoms and the periodic table are learned in high school chemistry.] [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-PS1-1)*

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-PS1-2)*

Unit Sequence	
Part A: If the universe is not made of Legos®, then what is it made of?	
Concepts	Formative Assessment
<ul style="list-style-type: none"> • Substances are made from different types of atoms. ✓ Atoms are the basic units of matter. • Substances combine with one another in various ways. ✓ Molecules are two or more atoms joined together. • Atoms form molecules that range in size from two to thousands of atoms. ✓ Molecules can be simple or very complex. • Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). 	<p><i>Students who understand the concepts are able to:</i></p> <ul style="list-style-type: none"> • Develop a model of a simple molecule. • Use the model of the simple molecule to describe its atomic composition. • Develop a model of an extended structure. • Use the model of the extended structure to describe its repeating subunits. <p><i>[Boundary: The substructure of atoms and the periodic table are learned in high school chemistry.]</i></p>

Unit Sequence	
Part B: Is it possible to tell if two substances mixed or if they reacted with each other?	
Concepts	Formative Assessment
<ul style="list-style-type: none"> • Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. • Substances react chemically in characteristic ways. • In a chemical process, the atoms that make up the original substances are regrouped into different molecules; these new substances have different properties from those of the reactants. • The analysis of data on the properties of products and reactants can be used to determine whether a chemical process has occurred. • Density, melting point, boiling point, solubility, flammability, and odor are characteristic properties that can be used to identify a pure substance. • Macroscopic patterns are related to the nature of the atomic-level structure of a substance. 	<p><i>Students who understand the concepts are able to:</i></p> <ul style="list-style-type: none"> • Analyze and interpret data to determine similarities and differences from results of chemical reactions between substances before and after they undergo a chemical process. • Analyze and interpret data on the properties of substances before and after they undergo a chemical process. • Identify and describe possible correlation and causation relationships evidenced in chemical reactions. • Make logical and conceptual connections between evidence that chemical reactions have occurred and explanations of the properties of substances before and after they undergo a chemical process.

Connections to Other Units

Unit 6: Interactions 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.
- Gases and liquids are made of molecules or inert atoms that are moving about relative to each other.
- In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change relative locations.
- The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter.

Unit 7: 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.
- The total number of each type of atom is conserved, and thus the mass does not change.
- Some chemical reactions release energy, others store energy.

Appendix A: NGSS and Foundations for the Unit

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. The substructure of atoms and the periodic table are learned in high school chemistry.] [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-PS1-1)*

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-PS1-2)*

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p>Developing and Using Models</p> <ul style="list-style-type: none"> Develop a model to predict and/or describe phenomena. (MS-PS1-1) <p>Analyzing and Interpreting Data</p> <ul style="list-style-type: none"> Analyze and interpret data to determine similarities and differences in findings. (MS-PS1-2) 	<p>PS1.A: Structure and Properties of Matter</p> <ul style="list-style-type: none"> 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) Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). (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-PS1-2) <p>PS1.B: Chemical Reactions</p> <ul style="list-style-type: none"> 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) 	<p>Scale, Proportion, and Quantity</p> <ul style="list-style-type: none"> 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) <p>Patterns</p> <ul style="list-style-type: none"> Macroscopic patterns are related to the nature of microscopic and atomic-level structure. (MS-PS1-2) <p>-----</p> <p>Connections to Nature of Science</p> <p>Scientific Knowledge is Based on Empirical Evidence</p> <ul style="list-style-type: none"> Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-PS1-2)

English Language Arts	Mathematics
<p>Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. (MS-PS1-2) RST.6-8.1</p> <p>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-PS1-1), (MS-PS1-2) RST.6-8.7</p>	<p>Reason abstractly and quantitatively. (MS-PS1-1), (MS-PS1-2) MP.2</p> <p>Model with mathematics. (MS-PS1-1) MP.4</p> <p>Use ratio and rate reasoning to solve real-world and mathematical problems. (MS-PS1-1), (MS-PS1-2) 6.RP.A.3</p> <p>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</p>

	<p>express how many times as much one is than the other. (MS-PS1-1)</p> <p>8.EE.A.3</p> <p>Display numerical data in plots on a number line, including dot plots, histograms, and box plots. (MS-PS1-2) 6.SP.B.4</p> <p>Summarize numerical data sets in relation to their context. (MS-PS1-2)</p> <p>6.SP.B.5</p>
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Unit 5: Structure and Properties of Matter (20 days)			
This unit is based on:	SLO	Inquiry Menu	Quick Links
MS-PS1-1	Develop models to describe the atomic composition of simple molecules and extended structures	<ol style="list-style-type: none"> Marshmallow Molecules Building Atomic Models Simulation Investigation 	<ol style="list-style-type: none"> http://betterlesson.com/lesson/634009/marshmallow-molecules http://betterlesson.com/lesson/640284/building-atomic-models-simulation-investigation
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.	<ol style="list-style-type: none"> Chemical Reactions Un-Notes Chemical vs Physical Change Stations 	<ol style="list-style-type: none"> http://betterlesson.com/lesson/634016/chemical-reactions-un-notes <p>Attachment</p>

- Marshmallow Molecules – students use marshmallows and toothpicks to develop models of molecular structures! In addition, students utilize graphing to monitor their own learning. (Standards MS-PS1-1, SP2, SP8, Patterns)
- Building Atomic Models Simulation Investigation – students will be able to describe the structure and function of parts of atoms by comparing the charge, location, and relative mass of protons, neutrons, and electrons. (Standards MS-PS1-1, SP2, SP4, SP6, XC-SF-MS-1)
- Chemical Reactions Un-Notes – students watch three exciting demonstrations that allow them to come up with signs of a chemical reaction on their own. (Standards MS-PS1-2, SP2, SP4, SP7, Patterns)

4. Chemical vs Physical Change Stations – students use their knowledge of the signs of a chemical change to identify whether a physical or chemical change is occurring at each station. (Standards MS-PS1-2, SP4, SP7)

Unit 6: Interactions of Matter

Unit Summary	
<p>How can we trace synthetic materials back to natural ingredients?</p> <p>Students build understandings of what occurs at the atomic and molecular scale. Students apply their understanding that pure substances have characteristic properties and are made from a single type of atom or molecule. They also provide a molecular level accounts to explain states of matter and changes between states. The crosscutting concepts of <i>cause and effect</i>, <i>scale, proportion and quantity</i>, <i>structure and function</i>, <i>interdependence of science, engineering, and technology</i>, and <i>the influence of science, engineering and technology on society and the natural world</i> provide a framework for understanding the disciplinary core ideas. Students demonstrate grade appropriate proficiency in <i>developing and using models</i>, and <i>obtaining, evaluating, and communicating information</i>. Students are also expected to use the scientific and engineering practices to demonstrate understanding of the core ideas.</p>	
Student Learning Objectives	
<p>Gather and make sense of information to describe that synthetic materials come from natural resources and impact society. [Clarification Statement: <i>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.</i>] [Assessment Boundary: <i>Assessment is limited to qualitative information.</i>] (MS-PS1-3)</p>	
<p>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: <i>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 pure substances could include water, carbon dioxide, and helium.</i>] (MS-PS1-4)</p>	
Unit Sequence	
<p>Part A: How can you tell what the molecules are doing in a substance?</p>	
Concepts	Formative Assessment
<ul style="list-style-type: none"> • Changes in particle motion, temperature, and state of a pure substance occur when thermal energy is added or removed. • Qualitative molecular-level models of solids, liquids, and gases can be used to show that adding or removing thermal energy increases or decreases the kinetic energy of the particles until a change of state occurs. 	<p><i>Students who understand the concepts are able to:</i></p> <ul style="list-style-type: none"> • Develop a model that predicts and describes changes in particle motion that could include molecules or inert atoms or pure substances. • Use cause-and-effect relationships to predict changes in particle

- Gases and liquids are made of molecules or inert atoms that are moving about relative to each other.
- In a liquid, the molecules are constantly in contact with others.
- In a gas, the molecules are widely spaced except when they happen to collide.
- In a solid, atoms are closely spaced and may vibrate in position but do not change relative locations.
- The changes of state that occur with variations in temperature or pressure can be described and predicted using models of matter.
- The term heat as used in everyday language refers both to thermal energy and the transfer of that thermal energy from one object to another.
- Thermal energy is the motion of atoms or molecules within a substance.
- In science, heat is used to refer to the energy transferred due to the temperature difference between two objects.
- The temperature of a system is proportional to the average internal kinetic energy and potential energy per atom or molecule (whichever is the appropriate building block for the system's material).
- The details of the relationship between the average internal kinetic energy and the potential energy per atom or molecule 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.
- Cause-and-effect relationships may be used to predict and describe changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed in natural systems.

motion, temperature, and state of a pure substance when thermal energy is added or removed in natural or designed systems.

Unit Sequence	
Part B: How can we trace synthetic materials back to natural ingredients?	
<p>Concepts</p> <ul style="list-style-type: none"> • Each pure substance has characteristic physical and chemical properties that can be used to identify it. • Substances react chemically in characteristic ways. • In a chemical process, the atoms that make up the original substances are regrouped into different molecules. • New substances that result from chemical processes have different properties from those of the reactants. • Natural resources can undergo a chemical process to form synthetic material. • Structures can be designed to serve particular functions by taking into account properties of different materials and how materials can be shaped and used. • Engineering advances have led to discoveries of important synthetic materials, and scientific discoveries have led to the development of entire industries and engineered systems using these materials. • Technology use varies from region to region and over time. • The uses of technologies (engineered/synthetic materials) and any limitations on their use are driven by individual or societal needs, desires, and values. • The uses of technologies (engineered/synthetic materials) and any limitations on their use are driven by the findings of scientific research and by differences in such factors as climate, natural resources, and economic conditions. 	<p>Formative Assessment</p> <p><i>Students who understand the concepts are able to:</i></p> <ul style="list-style-type: none"> • Obtain, evaluate, and communicate information to show that synthetic materials come from natural resources and affect society. • Gather, read, and synthesize information about how synthetic materials formed from natural resources affect society. • Assess the credibility, accuracy, and possible bias of each publication and methods used within the publication. • Describe how information about how synthetic materials formed from natural resources affect society is supported or not supported by evidence.

Connections to Other Units
<p>Grade 7 Unit 5: Properties of Matter</p> <ul style="list-style-type: none"> • 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.
 - Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals).
 - Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it.
 - 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.
- Grade 7 Unit 7: 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.
 - The total number of each type of atom is conserved, and thus the mass does not change.
 - Some chemical reactions release energy, others store energy.

Appendix A: NGSS and Foundations for the Unit		
<p>Gather and make sense of information to describe that synthetic materials come from natural resources and impact society. [Clarification Statement: <i>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.</i>] [Assessment Boundary: <i>Assessment is limited to qualitative information.</i>] (MS-PS1-3)</p>		
<p>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: <i>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.</i>] (MS-PS1-4)</p>		
<p>The performance expectations above were developed using the following elements from the NRC document <i>A Framework for K-12 Science Education</i>:</p>		
Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p>Obtaining, Evaluating, and Communicating Information</p> <ul style="list-style-type: none"> • Gather, read, and synthesize information 	<p>PS1.A: Structure and Properties of Matter</p> <ul style="list-style-type: none"> • Each pure substance has characteristic physical and chemical properties (for any 	<p>Structure and Function</p> <ul style="list-style-type: none"> • Structures can be designed to serve particular functions by taking into account

<p>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)</p> <p>Developing and Using Models</p> <ul style="list-style-type: none"> Develop a model to predict and/or describe phenomena. (MS-PS1-4) 	<p>bulk quantity under given conditions) that can be used to identify it. (MS-PS1-3)</p> <ul style="list-style-type: none"> Gases 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) <p>PS1.B: Chemical Reactions</p> <ul style="list-style-type: none"> 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-PS1-3) <p>PS3.A: Definitions of Energy</p> <ul style="list-style-type: none"> 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. (<i>secondary to MS-PS1-4</i>) 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 	<p>properties of different materials, and how materials can be shaped and used. (MS-PS1-3)</p> <p>Cause and Effect</p> <ul style="list-style-type: none"> Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS1-4) <p>-----</p> <p>Connections to Engineering, Technology, and Applications of Science</p> <p>Interdependence of Science, Engineering, and Technology</p> <ul style="list-style-type: none"> 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) <p>Influence of Science, Engineering and Technology on Society and the Natural World</p> <ul style="list-style-type: none"> The uses of technologies and any limitation 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)
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	<p>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. (<i>secondary to MS-PS1-4</i>)</p>	
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English Language Arts	Mathematics
<p>Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. (MS-PS1-3) RST.6-8.1</p> <p>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-PS1-4) RST.6-8.7</p> <p>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. (MS-PS1-3) WHST.6-8.8</p>	<p>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) 6.NS.C.5</p>

Unit 6: Interactions of Matter (20 days)		
This unit is based on:	SLO	STEM
MS-PS1-3	Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.	1. Separating Mixtures: Discovery 2. Better Than Gold
MS-PS1-4	Develop a model that	3. Talk About Burning Your Money!
		Quick Links 1. http://betterlesson.com/lesson/640780/separating-mixtures-discovery 2. http://betterlesson.com/lesson/639724/better-than-gold 3. http://betterlesson.com/lesson/634014/talk-about-

	<p>predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.</p>	<p>4. Racing Molecules!</p>	<p><u>burning-your-money-phase-changes-endothemic-and-exothermic-reactions</u></p> <p>4. <u>http://betterlesson.com/lesson/635350/racing-molecules</u></p>
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- 1. Separating Mixtures: Discovery** The purpose of this lesson is to let students discover that all substances originally come from the earth. This lesson leaves a lot of room for student engagement and discussion. Students have the opportunity to explore the concept that all substances come from the Earth originally, that methods have to be used to separate the materials from the Earth, and that these methods could be harmful to land and people.
- 2. Better Than Gold** This lesson is a bit different from all the others as it is based solely on reading comprehension based on a scientific topic. It is based on building “contextual and background knowledge,” while incorporating significant vocabulary pertaining to this unit: *element, mining, rare Earth elements, metals, brine, evaporate, crust*. I like this activity because it takes a step back, allows students to read and have discussion amongst their peers, while using the 6.2, 6.3, 6.10 crosscutting concepts –all pertaining to where some of our most valuable minerals come from.
- 3. Talk About Burning Your Money!** This lesson starts with the nuts and bolts of understanding the structure of an atom to identifying what happens during an endothermic or exothermic reaction. **Science and Engineering Practices:** In reading and completing the "Let's Get Physical With Phase Changes" document, students use strategies to obtain scientific information and evidence from text (**SP7**). In addition, during class discussion, students back up their explanations in the lab document with evidence from their qualitative observations (**SP8**). **Crosscutting Concepts:** When students discuss what they saw in the lab in comparison to what they read in the text, students can begin to see patterns in the way that the state of matter and the molecular arrangement can change when thermal energy is added or removed. Thus, students can begin to see that macroscopic patterns are related to the nature of microscopic and atomic-level structure (**Patterns**). In creating patterns of energy transfer that occur in both phase changes and endothermic and exothermic reactions, students track how energy moves during various phase changes (**Energy and Matter**). Students eventually get the chance to “burn their money!” Students should eventually determine that the water evaporates as the rubbing alcohol burns. When the water evaporates it takes energy in from the dollar bill in order to burn, thus lowering the temperature of the dollar bill. Evaporation is an endothermic reaction that makes the surroundings (the dollar bill) feel colder.
- 4. Racing Molecules!** Students know that all matter is made up of atoms and atoms have energy. They are constantly in motion. Just how much faster are atoms in warm water compared to atoms in warm water? And if we could measure their speed how fast do they move - faster than a car, the speed of sound, the speed of light? Students will measure the difference in the speed of atoms in water of different temperatures. The lesson closes with a discussion based around which has more heat energy? A Bill Nye The Science Guy video is shown, where students can learn that all things hot and cold have heat energy. The amount of heat energy is related to the size of the object. Although the match feels warmer, it cannot melt the larger ice sculpture

Unit 7: Chemical Reactions

Unit Summary

How do substances combine or change (react) to make new substances?

Students provide molecular-level accounts of states of matters and changes between states, of how chemical reactions involve regrouping of atoms to form new substances, and of how atoms rearrange during chemical reactions. Students also apply their understanding of optimization design and process in engineering to chemical reaction systems. The crosscutting concept of *energy and matter* provides a framework for understanding the

<p>disciplinary core ideas. Students are expected to demonstrate proficiency in <i>developing and using models, analyzing and interpreting data, designing solutions, and obtaining, evaluating, and communicating information</i>. Students are also expected to use these science and engineering practices to demonstrate understanding of the disciplinary core ideas.</p>	
<p>Student Learning Objectives</p>	
<p>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. <i>[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-PS1-5)</i></p>	
<p>Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.* <i>[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.] (MS-PS1-6)</i></p>	
<p>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-ETS1-3)</p>	
<p>Unit Sequence</p>	
<p>Part A: What happens to the atoms when I bake a cake?</p>	
<p>Concepts</p> <ul style="list-style-type: none"> Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules. New substances created in a chemical process have different properties from those of the reactants. The total number of each type of atom in a chemical process is conserved, and thus the mass does not change (the law of conservation of matter). Matter is conserved because atoms are conserved in physical and chemical processes. The law of conservation of mass is a mathematical description of natural phenomena. 	<p>Formative Assessment</p> <p><i>Students who understand the concepts are able to:</i></p> <ul style="list-style-type: none"> Use physical models or drawings, including digital forms, to represent atoms in a chemical process. Use mathematical descriptions to show that the number of atoms before and after a chemical process is the same.

Unit Sequence	
Part B: How can a device be designed, constructed, tested, and modified that either releases or absorbs thermal energy by chemical processes?	
Concepts	Formative Assessment
<ul style="list-style-type: none"> • Some chemical reactions release energy, while others store energy. • The transfer of thermal energy can be tracked as energy flows through a designed or natural system. • Models of all kinds are important for testing solutions. • There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. • 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. • A solution needs to be tested and then modified on the basis of the test results in order to for it to be improved. • 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. • Some of the characteristics identified as having the best performance may be incorporated into the new design. 	<p><i>Students who understand the concepts are able to:</i></p> <ul style="list-style-type: none"> • Undertake a design project, engaging in the design cycle, to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes. • Specific criteria are limited to amount, time, and temperature of a substance. • Analyze and interpret data for the amount, time, and temperature of a substance in testing a device that either releases or absorbs thermal energy by chemical processes to determine similarities and differences in findings. • Develop a model to generate data for testing a device that either releases or absorbs thermal energy by chemical processes, including those representing inputs and outputs of thermal energy. • Track the transfer of thermal energy as energy flows through a designed system that either releases or absorbs thermal energy by chemical processes.

Connections to Other Units
<p>Grade 7 Unit 5: Properties of Matter</p> <ul style="list-style-type: none"> • 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. • Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). • Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify

it.

- 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.
- Grade 7 Unit 6: Interactions of Matter**
- Gases and liquids are made of molecules or inert atoms that are moving about relative to each other.
 - In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change relative locations.

Appendix A: NGSS and Foundations for the Unit

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-PS1-5)**

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.*] **(MS-PS1-6)**

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-ETS1-3).

The performance expectations above were developed using the following elements from the NRC document <i>A Framework for K-12 Science Education: Science and Engineering Practices</i>		Crosscutting Concepts	
Developing and Using Models	Disciplinary Core Ideas	Energy and Matter	
<ul style="list-style-type: none">• Develop a model to describe unobservable mechanisms. (MS-PS1-5) <p>Constructing Explanations and Designing Solutions</p>	<p>PS1.B: Chemical Reactions</p> <ul style="list-style-type: none">• 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	<ul style="list-style-type: none">• Matter is conserved because atoms are conserved in physical and chemical processes. (MS-PS1-5)• The transfer of energy can be tracked as energy flows through a designed or natural	

<ul style="list-style-type: none"> • Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints. (MS-PS1-6) <p>Analyzing and Interpreting Data</p> <ul style="list-style-type: none"> • Analyze and interpret data to determine similarities and differences in findings. (MS-ETS1-3) 	<p>different properties from those of the reactants. (MS-PS1-5)</p> <ul style="list-style-type: none"> • 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) <p>ETS1.B: Developing Possible Solutions</p> <ul style="list-style-type: none"> • 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) • There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-ETS1-3) • Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. (MS-ETS1-3) <p>ETS1.C: Optimizing the Design Solution</p> <ul style="list-style-type: none"> • 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) 	<p>system. (MS-PS1-6)</p> <hr/> <p>Connections to Nature of Science</p> <p>Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena</p> <ul style="list-style-type: none"> • Laws are regularities or mathematical descriptions of natural phenomena. (MS-PS1-5)
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	<ul style="list-style-type: none"> 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) 	
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English Language Arts	Mathematics
<p>Cite specific textual evidence to support analysis of science and technical texts. (MS-ETS1-3) RST.6-8.1</p> <p>Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. (MS-PS1-6) RST.6-8.3</p> <p>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-PS1-5) RST.6-8.7</p> <p>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-ETS1-3) RST.6-8.9</p> <p>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-PS1-6) (MS-ETS1-3) WHST.6-8.7</p> <p>Use ratio and rate reasoning to solve real-world and mathematical problems. (MS-PS1-5) 6.RP.A.3</p>	<p>Reason abstractly and quantitatively. (MS-PS1-5) (MS-ETS1-3) MP.2</p> <p>Model with mathematics. (MS-PS1-5) MP.4</p> <p>Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), 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-ETS1-3) 7.EE.3</p>

Unit : 7 Chemical Reactions			
This unit is based on:	SLO	Inquiry Menu	Quick Links
MS-PS1-5	Develop and use a model to	1. Law of Conservation of Matter Lab	1. http://betterlesson.com/lesson/603857/what-is-

	describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.	<p>2. Law of Conservation of Matter #2</p> <p>3. Balancing equations</p>	<p><u>conservation-of-matter</u></p> <p>2. http://betterlesson.com/lesson/641851/conservation-of-mass-investigation</p> <p>3. http://betterlesson.com/lesson/631279/balancing-equations</p> <p>4. Attachment</p> <p>5. Attachment</p>
MS-PS1-6	Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.	<p>4. Design a self-heating or cooling device</p> <p>5. Design a Cool Pack - activity</p>	
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.	<p>(This SLO is met by the summative projects listed above)</p>	<p>(see attachments 4 and 5)</p>

1. Students will carry out a chemical reaction in a closed container and an open container and compare the mass of the products. They will then model the reaction using paper cuts outs/etc. Then, students will answer analysis questions.
2. Students will carry out an investigation to show that mass is conserved in both physical and chemical changes using glow sticks and freezer pops.
3. Students will practice balancing equations using an interactive website.
4. Students will first observe various reactions and classify them as either exothermic or endothermic. Students will then choose chemicals to use the "design" a self-heating or cooling device, and present their product, based on evidence collected from the initial lab investigation. Students will also revisit MS-PS1-5 as part of this summative project.
5. Students will carry out an investigation to help them develop and design a lab to test endothermic reactions, and use the data to design a cool pack based on their observations.

Unit 8: Weather and Climate

Unit Summary

What factors interact and influence weather and climate?

This unit is broken down into three sub-ideas: Earth's large-scale systems interactions, the roles of water in Earth's surface processes, and weather and climate. Students make sense of how Earth's geosystems operate by modeling the flow of energy and cycling of matter within and among different systems. A systems approach is also important here, examining the feedbacks between systems as energy from the Sun is transferred between systems and circulates through the ocean and atmosphere. The crosscutting concepts of *cause and effect*, *systems and system models*, and *energy and matter* are called out as frameworks for understanding the disciplinary core ideas. In this unit, students are expected to demonstrate proficiency in *developing and using models* and *planning and carrying out investigations* as they make sense of the disciplinary core ideas. Students are also expected to use these practices to demonstrate understanding of the core ideas.

This unit is based on MS-ESS2-4, MS-ESS2-5, and MS-ESS2-6.

Student Learning Objectives

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-ESS2-4)

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-ESS2-5)

Explain how variations in density result from variations in temperature and salinity drive a global pattern of interconnected ocean currents. [Note: This SLO is based on a disciplinary core idea found in the Framework. It is included as a scaffold to the following SLO.] (ESS2.C)

Use a model to explain the mechanisms that cause varying daily temperature ranges in a coastal community and in a community located in the interior of the country. [Note: This SLO is based disciplinary core ideas found in the Framework. It is included as a scaffold to the following SLO.] (ESS2.C; ESS2.D)

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-ESS2-6)

Unit Sequence

Part A: What are the processes involved in the cycling of water through Earth's systems?

Concepts

- Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land.
- Global movements of water and its changes in form are propelled by sunlight and gravity.

Formative Assessment

Students who understand the concepts are able to:

- Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.
- Model the ways water changes its state as it moves through the

<ul style="list-style-type: none"> • The cycling of water through Earth's systems is driven by energy from the sun and the force of gravity. • Within Earth's systems, the transfer of energy drives the motion and/or cycling of water. 	<p>multiple pathways of the hydrologic cycle.</p>
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<p>Unit Sequence</p>	
<p>Part B: What is the relationship between the complex interactions of air masses and changes in weather conditions?</p>	
<p>Concepts</p> <ul style="list-style-type: none"> • The motions and complex interactions of air masses result in changes in weather conditions. • The complex patterns of the changes in and movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. • Examples of data that can be used to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions include weather maps, diagrams, and visualizations; other examples can be obtained through laboratory experiments. • Air masses flow from regions of high pressure to regions of low pressure, causing weather (defined by temperature, pressure, humidity, precipitation, and wind) at a fixed location to change over time. • Because patterns of the changes and the movement of water in the atmosphere are so complex, weather can only be predicted probabilistically. • Sudden changes in weather can result when different air masses collide. • Weather can be predicted within probabilistic ranges. • Cause-and-effect-relationships may be used to predict changes in weather. 	<p>Formative Assessment</p> <p><i>Students who understand the concepts are able to:</i></p> <ul style="list-style-type: none"> • Collect data to serve as the basis for evidence for how the motions and complex interactions of air masses result in changes in weather conditions.

<p>Unit Sequence</p>

Part C: What are the major factors that determine regional climates?

Concepts

- Unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.
- Patterns of atmospheric and oceanic circulation that determine regional climates vary by latitude, altitude, and geographic land distribution.
- Atmospheric circulation that, in part, determines regional climates is the result of sunlight-driven latitudinal banding, the Coriolis effect, and resulting prevailing winds.
- Ocean circulation that, in part, determines regional climates is the result of the transfer of heat by the global ocean convection cycle, which is constrained by the Coriolis effect and the outlines of continents.
- Models that can be used to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates can be diagrams, maps and globes, or digital representations.

Formative Assessment

Students who understand the concepts are able to:

- 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.

Connections to Other Units

Grade 7 Unit 5: 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.
- Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it.
- Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals).

Grade 7 Unit 6: Interactions 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.
- Gases and liquids are made of molecules or inert atoms that are moving about relative to each other.

- In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change relative locations.
- The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter.

Grade 8 Unit 3: 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).
- 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.
- 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.

Grade 8 Unit 4: 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.
- 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.
- 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)

Grade 8 Unit 5: Relationships among Forms 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.
- A system of objects may also contain stored (potential) energy, depending on their relative positions.
- When the motion energy of an object changes, there is inevitably some other change in energy at the same time.

Grade 8 Unit 6: Thermal Energy

- Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present.
- Energy is spontaneously transferred out of hotter regions or objects and into colder ones.
- 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.

Grade 8 Unit 7: The Electromagnetic Spectrum

- 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.
- 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.
- A wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media.
- However, because light can travel through space, it cannot be a matter wave, like sound or water waves.

Appendix A: NGSS and Foundations for the Unit

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-ESS2-4)

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-ESS2-5)

Explain how variations in density result from variations in temperature and salinity drive a global pattern of interconnected ocean currents. (ESS2.C)

Use a model to explain the mechanisms that cause varying daily temperature ranges in a coastal community and in a community located in the interior of the country. (ESS2.C; ESS2.D)

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-ESS2-6)

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-ESS2-4)

The Student Learning Objectives above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p>Developing and Using Models</p> <ul style="list-style-type: none"> Develop and use a model to describe phenomena. (MS-ESS2-6) Develop a model to describe unobservable mechanisms. (MS-ESS2-4) <p>Planning and Carrying Out Investigations</p> <ul style="list-style-type: none"> 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) 	<p>ESS2.C: The Roles of Water in Earth's Surface Processes</p> <ul style="list-style-type: none"> 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) 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) Global movements of water and its changes in form are propelled by sunlight and gravity. (MS-ESS2-4) Variations in density due to variations in temperature and salinity drive a global 	<p>Cause and Effect</p> <ul style="list-style-type: none"> Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-ESS2-5) <p>Systems and System Models</p> <ul style="list-style-type: none"> 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) <p>Energy and Matter</p> <ul style="list-style-type: none"> Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter. (MS-ESS2-4)

	<p>pattern of interconnected ocean currents. (MS-ESS2-6)</p> <p>ESS2.D: Weather and Climate</p> <ul style="list-style-type: none"> 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) 	
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English Language Arts	Mathematics
<p>Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS2-5),(MS-ESS3-5) RST.6-8.1</p> <p>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-ESS2-5) RST.6-8.9</p> <p>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. (MS-ESS2-5) WHST.6-8.8</p> <p>Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-ESS2-6) SL.8.5</p>	<p>Reason abstractly and quantitatively. (MS-ESS2-5),(MS-ESS3-5) MP.2</p> <p>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) 6.NS.C.5</p> <p>Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (MS-ESS3-5) 6.EE.B.6</p>

Unit 8: Weather and Climate (20 days)

This unit is based on:	SLO	STEM	Quick Links
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.	<ol style="list-style-type: none"> 1. Clouds and dew point activity 2. Water cycle model 3. Water cycle narrative 	<ol style="list-style-type: none"> 1. http://betterlesson.com/lesson/638295/clouds-and-dew-point-labs 2. http://betterlesson.com/lesson/638308/modeling-watersheds 3. http://betterlesson.com/lesson/637314/journey-through-the-water-cycle
MS-ESS2-5	<p>Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.</p> <p>ESS2.C Explain how variations in density result from variations in temperature and salinity drive a global pattern of interconnected ocean currents</p> <p>ESS2.C; ESS2.D Use a model to explain the mechanisms that cause varying daily temperature ranges in a coastal community and in a community located in the interior of the country.</p>	<ol style="list-style-type: none"> 4. Modeling weather fronts 5. Weather forecasting web-quest 	<ol style="list-style-type: none"> 4. http://betterlesson.com/lesson/638294/modeling-weather-fronts 5. http://betterlesson.com/lesson/638300/weather-forecasting-online-activity
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.	<ol style="list-style-type: none"> 6. Ocean currents change our Earth 7. The great ocean conveyor 8. Ocean currents 9. Global ocean and atmospheric circulation models 	<ol style="list-style-type: none"> 6. Attachment 7. Attachment 8. Attachment 9. http://betterlesson.com/lesson/638297/global-ocean-and-atmospheric-circulation-evaluating-models

1. Students will read an informational text on humidity, clouds, and dew point. Students will then participate in an activity where they will determine the dew point in the room and create a cloud in a bottle.
2. Students will model how the cycling of water through Earth's systems is driven by the sun and the force of gravity using everyday materials.
3. Students will write a first person narrative of the water cycle, from the perspective of a water molecule.
4. Students will develop models of warm and cold fronts using water of different temperatures, and will then use the models to make predictions about weather patterns.
5. Students will complete a web-quest to analyze various weather maps and data tables to predict changes in weather.
6. Students investigate how the salinity of water affects density.
7. Students investigate how salt affects the flow of water through the oceans.
8. Students will learn about the influences of wind, water temperature, landmasses, and water density on currents by carrying out an investigation.
9. Students will combine information they gained from models, videos, demonstrations, and articles, to explain how the rotation and uneven heating of the Earth cause patterns of oceanic and atmospheric circulation.

Unit 9: Earth Systems

Unit Summary

If no one was there, how do we know the Earth's history?

What provides the forces that drive Earth's systems?

Students examine geoscience data in order to understand processes and events in Earth's history. Important crosscutting concepts in this unit are *scale, proportion, and quantity, stability and change, and patterns* in relation to the different ways geologic processes operate over geologic time. An important aspect of the history of Earth is that geologic events and conditions have affected the evolution of life, but different life forms have also played important roles in altering Earth's systems. Students understand how Earth's geosystems operate by modeling the flow of energy and cycling of matter within and among different systems. Students investigate the controlling properties of important materials and construct explanations based on the analysis of real geoscience data. Students are expected to demonstrate proficiency in *analyzing and interpreting* data and *constructing explanations*. They are also expected to use these practices to demonstrate understanding of the core ideas.

Student Learning Objectives

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-ESS1-4)**

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-ESS2-1)**

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-ESS2-2)**

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.] **(MS-ESS2-3)**

Unit Sequence

Part A: How do we know that the Earth is approximately 4.6-billion-year-old history?

Concepts

- The geologic time scale is used to organize Earth's 4.6-billion-year-old history.
- Rock formations and the fossils they contain are used to establish relative ages of major events in Earth's history.
- 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.

Formative Assessment

Students who understand the concepts are able to:

- Construct a scientific explanation based on valid and reliable evidence from rock strata obtained from sources (including the students' own experiments).
- Construct a scientific explanation based on rock strata 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.

<ul style="list-style-type: none"> Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.
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Unit Sequence	
Part B: What drives the cycling of Earth's materials?	
Concepts <ul style="list-style-type: none"> Energy drives the process that results in the cycling of Earth's materials. The processes of melting, crystallization, weathering, deformation, and sedimentation act together to form minerals and rocks through the cycling of Earth's materials. All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. Energy flowing and matter cycling within and among the planet's systems derive from the sun and Earth's hot interior. Energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms. Explanations of stability and change in Earth's natural systems can be constructed by examining the changes over time and processes at different scales, including the atomic scale. 	Formative Assessment <i>Students who understand the concepts are able to:</i> <ul style="list-style-type: none"> Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.

Unit Sequence	
Part C: Do all of the changes to Earth systems occur in similar time scales?	
Concepts <ul style="list-style-type: none"> Geoscience processes have changed Earth's surface at varying time and spatial scales. Processes change Earth's surface at time and spatial scales that can be large or small; many geoscience processes usually behave gradually but are punctuated by catastrophic events. Geoscience processes shape local geographic features. The planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to 	Formative Assessment <i>Students who understand the concepts are able to:</i> <ul style="list-style-type: none"> Construct a scientific explanation for how geoscience processes have changed Earth's surface at varying time and spatial scales based on valid and reliable evidence obtained from sources (including the students' own experiments). Construct a scientific explanation for how geoscience processes have changed Earth's surface at varying time and spatial scales based on the assumption that theories and laws that describe the natural

<p>billions of years.</p> <ul style="list-style-type: none"> • Interactions among Earth's systems have shaped Earth's history and will determine its future. • Water's movements—both on the land and underground—cause weathering and erosion, which change the land's surface features and create underground formations. • Time, space, and energy phenomena within Earth's systems can be observed at various scales using models to study systems that are too large or too small. 	<p>world operate today as they did in the past and will continue to do so in the future.</p> <ul style="list-style-type: none"> • Collect evidence about processes that 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). • Collect evidence about processes that change Earth's surface at time and spatial scales that can be 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.
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Unit Sequence	
Part D: <i>How is it possible for the same kind of fossils to be found in New Jersey and in Africa?</i>	
Concepts	Formative Assessment
<ul style="list-style-type: none"> • Tectonic processes continually generate new sea floor at ridges and destroy old sea floor at trenches. • 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. • Patterns in rates of change and other numerical relationships can provide information about past plate motions. • The distribution of fossils and rocks, continental shapes, and sea floor structures to provide evidence of past plate motions. • 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) provide evidence of past plate motions. 	<p><i>Students who understand the concepts are able to:</i></p> <ul style="list-style-type: none"> • Analyze and interpret data such as distributions of fossils and rocks, continental shapes, and sea floor structures to provide evidence of past plate motions. • Analyze how science findings have been revised and/or reinterpreted based on new evidence about past plate motions.

Connections to Other Units
<p>Grade 7 Unit 5: Structure and Properties of Matter</p> <ul style="list-style-type: none"> • 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.

- Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it.
- Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals).

Grade 7 Unit 6: Interactions of Matter

- Gases and liquids are made of molecules or inert atoms that are moving about relative to each other.
- In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change relative locations.
- The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter.
- 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.

Grade 7 Unit 7: Chemical Reactions

- The total number of each type of atom is conserved, and thus the mass does not change.
- Some chemical reactions release energy, others store energy.

Grade 8 Unit 1: Human Impacts on Earth Systems and Global Climate Change

- Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things.
- Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.

Grade 8 Unit 4: Relationships among Forms of Energy

- A system of objects may also contain stored (potential) energy, depending on their relative positions.
- Energy is spontaneously transferred out of hotter regions or objects and into colder ones.

Grade 7 Unit 9: Earth 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.
- 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.

Appendix A: NGSS and Foundations for the Unit

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-ESS1-4)

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-ESS2-1)

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-ESS2-2)

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.] (MS-ESS2-3)

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p>Developing and Using Models</p> <ul style="list-style-type: none"> Develop and use a model to describe phenomena. (MS-ESS2-1) <p>Constructing Explanations and Designing Solutions</p>	<p>ESS1.C: The History of Planet Earth</p> <ul style="list-style-type: none"> 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) 	<p>Stability and Change</p> <ul style="list-style-type: none"> 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. (MS-ESS2-1)

<ul style="list-style-type: none"> 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 nature operate today as they did in the past and will continue to do so in the future. (MS-ESS1-4),(MS-ESS2-2) <p>Analyzing and Interpreting Data</p> <ul style="list-style-type: none"> Analyze and interpret data to provide evidence for phenomena. (MS-ESS2-3) 	<p>ESS2.A: Earth's Materials and Systems</p> <ul style="list-style-type: none"> 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) 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) <p>ESS2.B: Plate Tectonics and Large-Scale System Interactions</p> <ul style="list-style-type: none"> 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) 	<p>Scale Proportion and Quantity</p> <ul style="list-style-type: none"> 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) <p>Patterns</p> <ul style="list-style-type: none"> Patterns in rates of change and other numerical relationships can provide information about natural systems. (MS-ESS2-3) <p>-----</p> <p>Connections to Nature of Science</p> <p>Scientific Knowledge is Open to Revision in Light of New Evidence</p> <ul style="list-style-type: none"> Science findings are frequently revised and/or reinterpreted based on new evidence. (MS-ESS2-3)
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<p>English Language Arts</p> <p>Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS1-4),(MS-ESS2-2) RST.6-8.1</p> <p>Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (MS-ESS1-4),(MS-ESS2-2) WHST.6-8.2</p> <p>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) RST.6-8.7</p>	<p>Mathematics</p> <p>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. (MS-ESS2-2),(MS-ESS2-3) 7.EE.B.4</p> <p>Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (MS-ESS1-4),(MS-ESS2-2),(MS-ESS2-3) 6.EE.B.6</p> <p>Use variables to represent quantities in a real-world or mathematical</p>
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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) **RST.6-8.9**

Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-ESS2-1),(MS-ESS2-2) **SL.8.5**

problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. (MS-ESS1-4) **7.EE.B.6**

Reason abstractly and quantitatively. (MS-ESS2-2),(MS-ESS2-3) **MP.2**

Unit : 9 Earth Systems			
This unit is based on:	SLO	Inquiry Menu	Quick Links
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	<ol style="list-style-type: none"> 1. Geologic Time Mini-Project 2. DBQ – Oxygen in Earth's Atmosphere 	<ol style="list-style-type: none"> 1. http://betterlesson.com/lesson/637351/geologic-time-mini-project 2. Attachment
MS-ESS2-1	Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process	<ol style="list-style-type: none"> 3. Rock Cycle Anticipatory question and notes 4. Weathering and Erosion Activity 	<ol style="list-style-type: none"> 3. http://betterlesson.com/lesson/6353443/rock-cycle 4. Attachment
MS-ESS2-2	Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales	<ol style="list-style-type: none"> 5. The Story of Earth – video 6. Impact of the meteor strike 7. Earthquake STEAM 	<ol style="list-style-type: none"> 5. https://www.youtube.com/watch?v=SYOarZKipnU 6. http://betterlesson.com/lesson/638788/history-of-earth-part-1-problem-solving 7. Attachment
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	<ol style="list-style-type: none"> 8. A Plate Tectonics Puzzle 9. Modeling Sea-Floor Spreading Activity 10. Mid-ocean Ridge activity (interactive website) 	<ol style="list-style-type: none"> 8. http://www.amnh.org/explore/curriculum-collections/dinosaurs-activities-and-lesson-plans/plate-tectonics-puzzle 9. "Inside Earth" Textbook – p.31

		http://oceanexplorer.noaa.gov/edu/learning/player/lesson02/l2la1.htm
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1. Students will research units of Earth's history and present the events that occurred during that time frame to the class in the form of a travel brochure.
2. Students will read an article on how scientists use rock layers to determine when oxygen first appeared in Earth's atmosphere and answer questions based on the text.
3. Students will decide which of three statements about rocks they agree with, and justify their choice using evidence. A power-point is also provided to enhance the lesson (a video link is included as well).
4. Students will model weathering and erosion with a series of activities.
5. Students will watch (portions of) a video that explains how Earth formed and has been changing over the past 4.6 billion years.
6. Students will use a portion of the video from activity #5 to have students map out the cause and effect of a meteor landing and see that events may start locally but can end up having a global impact.
7. Earthquake STEAM – students research earthquake proof/safe building materials and structures, in cooperative groups they construct towers designed to withstand earthquake waves, towers are tested for their ability to withstand damage on an earthquake board
8. Students will use logic and the evidence to reconstruct the position of large islands and continents as they appeared 220 million years ago.
9. Students will use a model to explain how sea floor spreading adds material to the ocean floor.
10. This activity consists of naming the continents, identifying mid-ocean ridges, and determining the age of the ocean floor. Once you have labeled each map correctly, you should be able to answer the series of questions that follow the exercise. The final map will allow you to explore all of the maps using a slide scale located above each tab. Navigating with the slide will provide different views of the maps, which will help with understanding the relationship between the continents, mid-ocean ridges and the age of the ocean floor.