Cedar Grove School District

Cedar Grove, NJ

2017 | Grade 6

Science

Approved by the Cedar Grove Board of Education

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Grade 6 - Science

Unit 1: Earth's Place in the Universe | Instructional Time: 25 Days

In this unit of study the students will examine the Earth's place in the solar system, the Milky Way galaxy and the universe. They will also develop and use a model of the Earth, moon, and sun system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons. They will develop a model to illustrate the force of gravity in the motions of the galaxies and solar system. They should understand that the force of gravity is the main factor in holding together the solar system and the universe. Further, the students should have an understanding of scale within the universe based on instruments on Earth as well as instruments in space.

Student Learning Objectives

New Jersey Student Learning Standards for Science/ NGSS

MS-ESS1-1	Develop and use a model of Earth to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and the causes for the seasons.
MS-ESS1-2	Develop and use a model to describe the role of gravity as the major force in the operation in the universe.
MS-ESS1-3	Analyze and interpret data to determine scale and proportion of objects in the solar system.

Enduring Understandings	Essential Questions
• Students will understand the natural forces that affect the Earth and its motions. • Gravity is the controlling force of motion in the solar system. • Space exploration changes with technological advancement.	• What patterns do we notice when observing the sky? • What effect does Earth's gravitational force have on objects? • What effect does the relative distance from Earth have on the apparent brightness of the sun and other stars? • What patterns do we notice when observing the sky?
Concepts	**Formative Assessment**
• Cause-and-effect relationships are routinely identified and used to explain change. • The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center. • Natural objects exist from the very small to the immensely large • The sun is a star that appears larger and brighter than other stars because it is closer. • Stars range greatly in their distance from Earth. • Similarities and differences in patterns can be used to sort, classify, communicate, and analyze simple rates of change for natural phenomena. • The orbits of Earth around the sun and of the moon around Earth, together with the rotation of Earth about an axis between its north and south poles, cause observable patterns. These include: *Day and night* • Daily changes in the length and direction of shadows • Different positions of the sun, moon, and stars at different times of the day, month, and year.	• Identify cause and effect relationships in order to explain change. • Support an argument that differences in the apparent brightness of the sun compared to that of other stars is due to their relative distances from Earth. • Represent data in graphical displays (bar graphs, pictographs and/or pie charts) to reveal patterns that indicate relationships. • Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky. • Examples of patterns could include: • The position and motion of Earth with respect to the sun. • Selected stars visible only in particular months.

Suggested Learning Activities

In this unit of study suggested learning activities would encompass labs, hands on activities, and modeling the Earth, Moon, and Sun system. Activities could include:

- Modeling the Sun as the center of the solar system as objects move around the sun
- Modeling both solar and lunar eclipses
- Modeling rotation and how it affects shape

- Demonstrating how density changes on the planets
- Modeling how nuclear fusion affects a star's energy
- Identifying landforms on the Moon by using NASA information
- Identifying planets based on individual planet information

Performance Expectation

Science and Engineering Practices	DCI	Crosscutting Concepts
Developing and Using Models • Develop and use models to predict phenomena. (MS-ESS1-1),(MS-ESS1-2) **Analyzing and Interpreting Data** • Analyze and interpret data to determine similarities and differences. (MS-ESS1-3) **Constructing Explanations and Designing Solutions** • Construct a scientific explanation based on evidence from reliable sources. (MS-ESS1- 4)	**ESS1.A: The Universe and Its Stars** • Patterns of apparent motion in the sky can be observed, described, predicted and explained. (MS-ESS1-1) • The Earth's solar system is a small part of the Milky Way Galaxy, one of many in the universe. (MS-ESS1-2) **ESS1.B: Earth and the Solar System** • The solar system is held together by the force of gravity which also hold the universe together. (MS-ESS1-1) • The solar system formed from a cloud of dust and gas drawn together by the force of gravity. .(MS-ESS1-2)	**Patterns** • Patterns can be used to identify cause and effect relationships. (MS-ESS1-1) **Systems and System Models** • Models can be used to represent systems and how they interact. (MS-ESS1-2) • Time, space, and energy phenomena can be observed using models to study systems that are too large or too small. (MS-ESS1-3)

Cross-Curricular Connections

English/Language Arts Standards	Mathematics Standards
• Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. (5-PS2-1), (5-ESS1-1) **RI.5.1** • Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (5-ESS1-1) **RI.5.7** • Explain how an author uses reasons and evidence to support particular points in a text, identifying which reasons and evidence support which point(s). (5-ESS1-1) **RI.5.8** • Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (5-PS2-1), (5-ESS1-1) **RI.5.9** • Write opinion pieces on topics or texts, supporting a point of view with reasons and information. (5-PS2-1), (5-ESS1-1) **W.5.1** • Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes. (5-ESS1-2) **SL.5.5**	• Reason abstractly and quantitatively. (5-ESS1-1),(5-ESS1-2) **MP.2** • Model with mathematics. (5-ESS1-1,(5-ESS1-2)) **MP.4** • Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. • Use whole-number exponents to denote powers of 10. (5-ESS1-1) **5.NBT.A.2** • Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation. (5-ESS1-2) **5.G.A.2**

21st Century Career Ready Practices

9.2 Career Awareness, Exploration, and Preparation

- This standard outlines the importance of being knowledgeable about one's interests and talents, and being well informed about postsecondary and career options, career planning, and career requirements.

9.3 Career and Technical Education

- This standard outlines what students should know and be able to do upon completion of a CTE Program of Study

Grade 6 - Science

Unit 2: Earth and Human Activity | Instructional Time: 15 Days

In this unit of study the emphasis will focus on the natural hazards on Earth and how they impact human life. Emphasis will be placed on how some natural occurrences like volcanoes and severe weather can be predicted by natural phenomena. Other occurrences, like earthquakes can occur suddenly and with little or no notice and are therefore not yet predictable. Examples of natural processes can be taken from interior processes, surface processes, and severe weather events. Examples of data can include locations, magnitudes, and frequencies of natural hazards. Examples of technologies can be global from satellite systems to the local systems.

Student Learning Objectives

New Jersey Student Learning Standards for Science/ NGSS

MS-ESS3-2	Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.

Enduring Understandings	Essential Questions
• Earthquakes and volcanoes are natural occurrences and happen in certain locations. • Volcanoes and earthquakes are caused by natural features of the Earth. • Technological information can be used to help predict natural disasters. • How natural events will affect land use throughout history	• Where do most earthquakes occur? • Where do most volcanoes form? • How are landforms related to plate tectonics? • How can scientists use information to protect human life?

Concepts	Formative Assessment
• Natural hazards can be the result of interior processes, surface processes, or severe weather events. • Some natural hazards, such as volcanic eruptions and severe weather, are preceded by phenomena that allow for reliable predictions, but others, such as earthquakes, occur suddenly and with no notice, and thus are not yet predictable. • Mapping the history of natural hazards in a region, combined with an understanding of related geologic forces, can help forecast the locations and likelihoods of future events. • Data on natural hazards can be used to forecast future catastrophic events and inform the development of technologies to mitigate their effects. • Data on natural hazards can include the locations, magnitudes, and frequencies of the natural hazards. • Graphs, charts, and images can be used to identify patterns of natural hazards in a region. • Graphs, charts, and images can be used to understand patterns of geologic forces that can help forecast the locations and likelihoods of future events. • Technologies that can be used to mitigate the effects of natural hazards can be global or local. • Technologies used to mitigate the effects of natural hazards vary from region to region and over time.	• Analyze and interpret data on natural hazards to determine similarities and differences and to distinguish between correlation and causation.

Suggested Learning Activities

Suggested learning activities for this unit can include hands-on activities, labs and using data from maps and computer driven data. Activities can include:

- What happens when a volcano erupts

- Modeling changes at plate boundaries can cause earthquakes
- Using maps to demonstrate earthquake and volcano boundaries
- Using data from NASA
- Using data from the Unites States Geographical Survey on earthquakes and volcanoes

Performance Expectation		
Science and Engineering Practices	**DCI**	**Crosscutting Concepts**
Analyzing and Interpreting Data • Analyzing data in 6–8 builds on K–5 and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. (MS-ESS2-2) • Analyze and interpret data to determine similarities and differences in findings. (MS-ESS3-2)	**ESS3.B: Natural Hazards** • Mapping the history of natural hazards in a region, combined with an understanding of related geologic forces can help forecast the locations and likelihoods of future events. (MS-ESS3-2)	**Patterns** • Graphs, charts, and images can be used to identify patterns in data. (MS-ESS3-2)

Cross-Curricular Connections	
English/Language Arts Standards	**Mathematics Standards**
• Convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (MS-ESS3-2) **WHST.6-8.8** • Cite specific textual evidence in data used to support the analysis of natural hazards and to forecast future catastrophic events and inform the development of technologies to mitigate their effects. (MS-ESS3-2) **RST.6-8.1** • Integrate quantitative or technical information about natural hazards and forecasting future catastrophic events that is expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-ESS3-2) **RST.6-8.7** • Use the integrated text and visual displays to analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects. (MS-ESS3-2) **RST.6-8.7** • Cite specific textual evidence to support an argument about the role of human activity and natural processes in the gradual increase in global temperatures over the past century. (MS-ESS3-2) **RST.6-8.1**	• Convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (MS-ESS3-2) **MP.2** • Construct simple equations and inequalities to solve problems by reasoning about the quantities. (MS-ESS3-2) **MP.2** • Analyze and interpret data on natural hazards by reasoning abstractly (manipulating symbols abstractly) and quantitatively (while attending to the meaning of those symbols) to forecast future catastrophic events and inform the development of technologies to mitigate their effects. (MS-ESS3-2) **MP.2** • Use variables to represent numbers and write expressions for the locations, magnitudes, and frequencies of natural hazards and how these data can be used to forecast future catastrophic events and inform the development of technologies to mitigate their effects. The variable can represent an unknown number or, depending on the purpose at hand, any number in a specified set. (MS-ESS3-2) **6.EE.B.6** • Use variables to represent quantities for the location, magnitudes, and frequencies of natural hazards and how these data can be used to forecast future catastrophic events and inform the development of technologies to mitigate their effects. (MS-ESS3-2) **6.EE.B.6** • Construct simple equations and inequalities to solve problems by reasoning about the quantities. (MS-ESS3-2) **6.EE.B.6** • Students will clarify evidence of the factors that have caused the rise in global temperatures over the past century, reasoning abstractly (manipulating symbols abstractly) and quantitatively (while attending to the meaning of those symbols). (MS-ESS3-2) **6.EE.B.6**

	• Use variables to represent numbers and write expressions for data found in tables, graphs, and maps of global and regional temperatures; atmospheric levels of gases such as carbon dioxide and methane' and the rates of human activities. The variable can represent an unknown number or, depending on the purpose at hand, any number in a specified set. (MS-ESS3-2) **6.EE.B.6** • Use variables to represent quantities found in tables, graphs, and maps of global and regional temperatures, atmospheric levels of gases such as carbon dioxide and methane, and the rates of human activities. Construct simple equations and inequalities to solve problems by reasoning about the quantities. (MS-ESS3-2) **6.EE.B.6**
21st Century Career Ready Practices	
9.2 Career Awareness, Exploration, and Preparation • This standard outlines the importance of being knowledgeable about one's interests and talents, and being well informed about postsecondary and career options, career planning, and career requirements. **9.3 Career and Technical Education** • This standard outlines what students should know and be able to do upon completion of a CTE Program of Study	

Grade 6 - Science

Unit 3: Earth Systems | Instructional Time: 20 Days

In this unit of study on the Earth's systems the students will come to realize that there is a continuous flow of energy through the Earth. This flow of energy causes the processes of melting, crystallization, weathering, deformation, and sedimentation that form minerals and rocks throughout the Earth's systems. Also, throughout the Earth's systems is the continuous flow of water that is driven by the energy of the sun and the force of gravity.

Student Learning Objectives

New Jersey Student Learning Standards for Science/ NGSS

MS-ESS2-1	Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process
MS-ESS2-4	Develop a model that describes the cycling of water through the Earth's systems driven by the energy from the Sun and from the force of gravity

Enduring Understandings	Essential Questions
• Students will come to understand that there are natural forces that shape the Earth • Students will understand that the Earth is composed of natural and basic materials that all matter is built upon • Students will understand that the relationship between the Earth and Sun affects the water cycle on Earth	• What are the basic materials that make up the Earth and how have they changed over time? • What are the internal and external natural forces that shape and change the Earth? • How does the Sun create and affect the flow of water on the Earth?

Concepts	Formative Assessment
• 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. • 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. • 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.	• Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process. • 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 world operate today as they did in the past and will continue to do so in the future. • 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. • 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 multiple pathways of the hydrologic cycle.

Suggested Learning Activities

Suggested learning activities for this unit could encompass hands-on activities, labs and demonstrations and models

for the flow of energy through the Earth and the movement of water on Earth. Activities may include:

- Creating a *Wordle (http://www.wordle.com)* that describes the Earth
- Creating a model to describe the water cycle
- Using a lab to identify characteristics of minerals and rocks
- Using a model to describe erosion and sedimentation
- Identifying how plants affect the water cycle on Earth

Performance Expectation

Science and Engineering Practices	DCI	Crosscutting Concepts
Developing and Using Models • Develop and use a model to describe phenomena. (MS-ESS2-1),(MS-ESS2-6) • Develop a model to describe unobservable mechanisms. (MS-ESS2-4)	**ESS2.A: Earth's Materials and Systems** • All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the sun and Earth's hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms. (MS-ESS2-1) **ESS2.C: The Roles of Water in Earth's Surface Processes** • Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land. (MS-ESS2-4) • Global movements of water and its changes in form are propelled by sunlight and gravity. (MS-ESS2-4)	**Stability and Change** • Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and processes at different scales, including the atomic scale. (MS-ESS2-1) **Energy and Matter** • Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter. (MS-ESS2-4)

Cross-Curricular Connections

English/Language Arts Standards	Mathematics Standards
• Support the analysis of science and technical texts by citing specific textual evidence for how the motions and complex interactions of air masses result in changes in weather conditions. (MS-PS4-3) **WHST.6-8.9**	• Reason abstractly and quantitatively by using data such as weather maps, diagrams, and visualizations or obtained through laboratory experiments to predict weather within probabilities ranges. (MS-PS1-1),(MS-PS1-2) **MP.2**
• Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with information that is gained from reading text about how the complex patterns of the changes and movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents are major determinants of local weather patterns. (MS-LS4-4) **RST.6-8.9**	• Understand that positive and negative numbers are used together to describe quantities having opposite directions or values. Use positive and negative numbers to represent changes in atmospheric and oceanic temperatures, explaining the meaning of 0 in each situation.

21st Century Career Ready Practices

9.2 Career Awareness, Exploration, and Preparation

- This standard outlines the importance of being knowledgeable about one's interests and talents, and being well informed about postsecondary and career options, career planning, and career requirements.

9.3 Career and Technical Education

- This standard outlines what students should know and be able to do upon completion of a CTE Program of Study

Grade 6 - Science

Unit 4: Photosynthesis and Chemical Reactions | Instructional Time: 20 Days

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.

Student Learning Objectives

New Jersey Student Learning Standards for Science/ NGSS

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.
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.

Enduring Understandings	Essential Questions
• Abiotic factors are nonliving • Biotic factors are living • All plants use energy to produce and use food. • All plants convert energy into food using a chemical reaction.	• How do organisms obtain energy? • What is the relationship between photosynthesis and cellular respiration? • How do plants produce sugar? • How do plants store and use energy?
Concepts	**Formative Assessment**
• Photosynthesis has a role in the cycling of matter and flow of energy into and out of organisms. • 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. 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	• 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. • Develop and use a model to describe how food is rearranged through chemical reactions

released.
- Cellular respiration in plants and animals involves chemical reactions with oxygen that release stored energy.

Suggested Learning Activities

In this unit of study suggested learning activities would encompass labs, hands on activities, and models. Activities could include:

- Demonstrating how light affects plant growth
- Removing chlorophyll from plant leaves
- How external stimulus affect the growth of plants
- Modeling the movement of water through a plant

Performance Expectation

Science and Engineering Practices	DCI	Crosscutting Concepts
Constructing Explanations and Designing Solutions • Construct a scientific explanation and design a solution based on valid and reliable sources. (MS-LS1-5),(MS-LS1-6) **Developing and Using Models** • Develop a model to describe unobservable mechanisms. (MS-LS1-7)	**LS1.C: Organization for Matter and Energy Flow in Organisms** • Plants use sunlight to make sugars from carbon dioxide from the atmosphere and water through photosynthesis which release oxygen. (MS-LS1-6) • The chemical reactions that plants use to produce food require an energy input. (MS-LS1-5) • Cellular respiration in plants and animals involve chemical reactions with oxygen that release stored energy in these processes. (MS-LS1-5)	**Energy and Matter** • Matter is conserved because atoms are conserved in physical and chemical processes. (MS-LS1-7) • Within a natural system, the transfer of energy drives the motion and/or cycling of matter. (MS-LS1-6)

Cross-Curricular Connections

English/Language Arts Standards	Mathematics Standards
• Cite specific textual evidence to support analysis of science and technical texts about the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms. (MS-LS1-6)(MS-LS1-7) **RST.6-8.1** • Determine the central ideas about the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinion. (MS-LS1-6)(MS-LS1-7) **WHST.6-8.1** • Write informative/explanatory texts to examine the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms, and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (MS-LS1-6)(MS-LS1-7**)** **WHST.6-8.2** • Draw evidence from informational texts to support analysis, reflection, and research about the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms. (MS-LS1-6)(MS-LS1-	• Use variables to represent two quantities involved in the process whereby photosynthesis plays a part in the cycling of matter and energy into and out of organisms. MS-LS1-6)(MS-LS1-7) **6.EE.C.9** • 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. MS-LS1-6)(MS-LS1-7) **6.EE.C.9** • Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. MS-LS1-6)(MS-LS1-7) **6.SP.B.5**

7) WHST.6-8.9 • Integrate multimedia and visual displays into presentations about how food is rearranged through chemical reactions to form new molecules that support growth and/or release energy as the matter moves through an organism to clarify information, strengthen claims and evidence, and add interest. (MS-LS1-6)(MS-LS1-7) SL.8.5	
21st Century Career Ready Practices	
9.2 Career Awareness, Exploration, and Preparation • This standard outlines the importance of being knowledgeable about one's interests and talents, and being well informed about postsecondary and career options, career planning, and career requirements. **9.3 Career and Technical Education** • This standard outlines what students should know and be able to do upon completion of a CTE Program of Study	

Grade 6 - Science

Unit 5: Biological Evolution | Instructional Time: 25 Days

In this unit of study the students will analyze pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in fully formed anatomy. The students will also construct an explanation based on evidence that describes how genetic variation of traits in a population increases some individuals' probability of surviving and reproducing in a specific environment. Further the students will study how natural selection may lead to increases or decreases of specific traits in populations over time.

Student Learning Objectives

New Jersey Student Learning Standards for Science/ NGSS

MS-LS4-3	Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy.
MS-LS4-4	Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.
MS-LS4-6	Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.

Enduring Understandings	Essential Questions
• Genetic variations of traits in a population increase or decrease some individuals' probability of surviving and reproducing in a specific environment. • Natural selection leads to the predominance of certain traits in a population and the suppression of others. • Natural selection may have more than one cause, and some cause-and effect relationships within natural selection can only be described using probability.	*Students who understand the concepts can:* • Construct an explanation that includes probability statements regarding variables and proportional reasoning of how genetic variations of traits in a population increase some individuals' probability. surviving and reproducing in a specific environment. • Use probability to describe some cause-and-effect relationships that can be used to explain why some individuals survive and reproduce in a specific environment.
Concepts	**Formative Assessment**
How can changes to the genetic code increase or decrease an individual's chances of survival? • Genetic variations of traits in a population increase or decrease some individuals' probability of surviving and reproducing in a specific environment. • Natural selection leads to the predominance of certain traits in a population and the suppression of others. • Natural selection may have more than one cause, and some cause-and effect relationships within natural selection can only be described using probability. *How can the environment effect natural selection?* • Natural selection, which over generations leads to adaptations, is one important process through which species change over time in response to changes in environmental conditions. • The distribution of traits in a population changes. • Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. • Natural selection may have more than one cause, and	• Construct an explanation that includes probability statements regarding variables and proportional reasoning of how genetic variations of traits in a population increase some individuals' probability surviving and reproducing in a specific environment. • Use probability to describe some cause-and-effect relationships that can be used to explain why some individuals survive and reproduce in a specific environment. • Explain some causes of natural selection and the effect it has on the increase or decrease of specific traits in populations over time. • Use mathematical representations to support conclusions about how natural selection may lead to increases and decreases of genetic traits in populations over time. • Assess the credibility, accuracy, and possible bias of publications and the methods they used when gathering information about technologies that have changed the way humans influence the inheritance of desired traits in organisms (artificial selection).

some cause-and effect relationships in natural selection can only be described using probability. • Mathematical representations can be used to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.	

Suggested Learning Activities

Suggested learning activities for this unit can include hands-on activities, labs and using data from maps and computer driven data. Activities can include:

- Classroom discussion of findings
- Gather reliable evidence from various sources
- Construct simulations
- Use of multimedia
- Modeling changes of the environment on living organisms

Performance Expectation

Science and Engineering Practices	DCI	Crosscutting Concepts
Analyze and Interpret Data • Analyze displays of data to identify linear and nonlinear relationships **Constructing Explanations and Designing Solutions** • Construct an explanation that includes qualitative or quantitative relationships between variables that describe phenomena. (MS-LS4-4) **Obtaining, Evaluating, and Communicating Information** • Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence. (MS-LS4-5) **Using Mathematics and Computational Thinking** • Use mathematical representations to support scientific conclusions and design solutions. (MSLS4-6)	**LS4.B: Natural Selection** • Natural selection leads to the predominance of certain traits in a population, and the suppression of others. (MS-LS4-4) • In artificial selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed on to offspring. (MS-LS4-5) LS4.C **Adaptation** • Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes. (MS-LS4-6)	**Cause and Effect** • Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (MS-LS4- 4),(MS-LS4-5),(MS-LS4-6) **Connections to Engineering, Technology, and Applications of Science Interdependence of Science, Engineering, and Technology** • Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems. (MS-LS4-5) **Connections to Nature of Science Science Addresses Questions About the Natural and Material World** • Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes. (MSLS4-5)

Cross-Curricular Connections

English/Language Arts Standards	Mathematics Standards
• Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. (MS-LS4-4),(MSLS4-5) **RST.6-8.1** • Compare and contrast the information gained from experiments, simulations, videos, or multimedia sources with that gained from reading a text on the	• Model with mathematics. (MS-LS4-6) **MP.4** • Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. (MS-LS4-4),(MS-LS4-6) 6**.RP.A.1** • Summarize numerical data sets in relation to their context. (MS-LS4-4),(MS-LS4- 6) **6.SP.B.5** • Recognize and represent proportional relationships

same topic. (MS-LS4-4) **RST.6-8.9** • Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (MS-LS4-4) **WHST.6-8.2** • 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-LS4-5) **WHST.6-8.8** • Draw evidence from informational texts to support analysis, reflection, and research. (MS-LS4-4) **WHST.6-8.9** • Engage effectively in a range of collaborative discussions (one-on-one, in groups, teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others' ideas and expressing their own clearly. (MS-LS4-4) **SL.8.1** • Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation. (MSLS4-4) **SL.8.4**	between quantities. (MS-LS4- 4),(MS-LS4-6) **7.RP.A.2**
21st Century Career Ready Practices	
9.2 Career Awareness, Exploration, and Preparation • This standard outlines the importance of being knowledgeable about one's interests and talents, and being well informed about postsecondary and career options, career planning, and career requirements. **9.3 Career and Technical Education** • This standard outlines what students should know and be able to do upon completion of a CTE Program of Study	

Grade 6 - Science

Unit 6: Energy | Instructional Time: 25 Days

In this unit, students use the practices of analyzing and interpreting data, developing and using models, and engaging in argument from evidence to make sense of relationship between energy and forces. Students develop their understanding of important qualitative ideas about the conservation of energy. Students understand that objects that are moving have kinetic energy and that objects may also contain stored (potential) energy, depending on their relative positions. Students also understand the difference between energy and temperature, and the relationship between forces and energy. The crosscutting concepts of scale, proportion, and quantity, systems and system models, and energy and matter are called out as organizing concepts for these disciplinary core ideas. Students use the practices of analyzing and interpreting data, developing and using models, and engaging in argument from evidence. Students are also expected to use these practices to demonstrate understanding of the core ideas.

Student Learning Objectives

New Jersey Student Learning Standards for Science/ NGSS

MS-PS3-1	Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.
MS-PS3-2	Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.
MS-PS3-5	Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.

Enduring Understandings	Essential Questions
• Energy exists in multiple forms • Energy can change forms • Energy can be transferred and transformed but not destroyed • Energy occurs in different forms and is necessary to do work and cause change • Force and motion are related to potential and kinetic energy • Motion is changed by an unbalanced force • Speed is a measure between distance and time	• What are the different forms of energy and how do they behave? • What is the difference between potential and kinetic energy? • How can energy be changed and conserved? • How do forces affect the motion of matter? • How can forces change the motion of matter?

Concepts	Formative Assessment
Is it better to have an aluminum (baseball/softball) bat or a wooden bat? • Kinetic energy is related to the mass of an object and to the speed of an object. • Kinetic energy has a relationship to mass separate from its relationship to speed. • Motion energy is properly called kinetic energy; it is proportional to the mass of the moving object and grows with the square of the object's speed. • Proportional relationships among different types of quantities provide information about the magnitude of properties and processes. • When the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system. • A system of objects may contain stored (potential) energy, depending on the objects' relative positions. • When two objects interact, each one exerts a force on the other that can cause energy to be transferred to or	**Students who understand the concepts can:** • Construct and interpret graphical displays of data to identify linear and nonlinear relationships of kinetic energy to the mass of an object and to the speed of an object. • Develop a model to describe what happens to the amount of potential energy stored in the system when the arrangement of objects interacting at a distance changes • Use models to represent systems and their interactions, such as inputs, processes, and outputs, and energy and matter flows within systems. Models could include representations, diagrams, pictures, and written descriptions. • Construct, use, and present oral and written arguments supported by empirical evidence and scientific reasoning to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object. • Conduct an inventory or other representation of the

from the objects. • Models that could include representations, diagrams, pictures, and written descriptions of systems can be used to represent systems and their interactions, such as inputs, processes, and outputs, and energy and matter flows within systems. **Who can design the best roller coaster?** • When the kinetic energy of an object changes, energy is transferred to or from the object. • When the motion energy of an object changes, there is inevitably some other change in energy at the same time. • Kinetic energy may take different forms (e.g., energy in fields, thermal energy, energy of motion).	energy before and after the transfer in the form of temperature changes or motion of an object. Do not include calculations of energy

Suggested Learning Activities

In this unit of study suggested learning activities would encompass labs, hands on activities, and models on energy and its various forms. Activities could include:

- Investigations on energy and its changes
- Using a car/marble ramp
- Creating a pinwheel and experiment with the spinning
- Using computers to research various energy forms
- Compare/contrast hybrid vehicles to conventional vehicles
- Research various alternative fuels
- Create models and graphs on energy use

Performance Expectation

Science and Engineering Practices	DCI	Crosscutting Concepts
Developing and Using Models • Develop a model to describe unobservable mechanisms. (MS-PS3-2) **Analyzing and Interpreting Data** • Construct and interpret graphical displays of data to identify linear and nonlinear relationships. (MS-PS3-1) **Engaging in Argument from Evidence** • Construct, use, and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon. (MSPS3-5) **Scientific Knowledge is Based on Empirical Evidence** • Science knowledge is based upon logical and conceptual connections between evidence and explanations (MS-PS3-5)	**PS3.A: Definitions of Energy** • Motion energy is properly called kinetic energy; it is proportional to the mass of the moving object and grows with the square of its speed. (MS-PS3-1) • A system of objects may also contain stored (potential) energy, depending on their relative positions. (MS-PS3-2) **PS3.B: Conservation of Energy and Energy Transfer** • When the motion energy of an object changes, there is inevitably some other change in energy at the same time. (MS-PS3-5) **PS3.C: Relationship Between Energy and Forces** • When two objects interact, each one exerts a force on the other that can cause energy to be transferred to or from the object. (MS-PS3-2)	**Scale, Proportion, and Quantity** • Proportional relationships (e.g. speed as the ratio of distance traveled to time taken) among different types of quantities provide information about the magnitude of properties and processes. (MS-PS3-1) **Systems and System Models** • Models can be used to represent systems and their interactions – such as inputs, processes, and outputs – and energy and matter flows within systems. (MS-PS3-2) **Energy and Matter** • Energy may take different forms (e.g. energy in fields, thermal energy, energy of motion). (MSPS3-5)

Cross-Curricular Connections

English/Language Arts Standards	Mathematics Standards
• Cite specific textual evidence to support analysis of	• Reason abstractly and quantitatively. (MS-PS3-1),(MS-

science and technical texts, attending to the precise details of explanations or descriptions. (MS-PS3-1),(MSPS3-5) **RST.6-8.1** • 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-PS3-1) **RST.6-8.7** • Write arguments focused on discipline content. (MS-PS3-5) **WHST.6-8.1** • Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. (MS-PS3-3) **WHST.6-8.7** • Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-PS3-2) **SL.8.5**	PS3-5) **MP.2** • Understand the concept of ratio and use ratio language to describe a ratio relationship between two quantities. (MS-PS3-1),(MS-PS3-5) **6.RP.A.1** • Understand the concept of a unit rate a/b associated with a ratio a:b with b ≠ 0, and use rate language in the context of a ratio relationship. (MS-PS3-1) 6**.RP.A.2** • Recognize and represent proportional relationships between quantities. (MSPS3-1),(MS-PS3-5**) 7.RP.A.2** • Know and apply the properties of integer exponents to generate equivalent numerical expressions. (MS-PS3-1) **8.EE.A.1**
21st Century Career Ready Practices	
9.2 Career Awareness, Exploration, and Preparation • This standard outlines the importance of being knowledgeable about one's interests and talents, and being well informed about postsecondary and career options, career planning, and career requirements. **9.3 Career and Technical Education** • This standard outlines what students should know and be able to do upon completion of a CTE Program of Study	

Grade 6 - Science

Unit 7: The Electromagnetic Spectrum — Instructional Days: 25 days

In this unit of study, students develop and use models, use mathematical thinking, and obtain, evaluate, and communicate information in order to describe and predict characteristic properties and behaviors of waves. Students also apply their understanding of waves as a means of sending digital information. The crosscutting concepts of patterns and structure and function are used as organizing concepts for these disciplinary core ideas. Students develop and use models, use mathematical thinking, and obtain, evaluate, and communicate information. Students are also expected to use these practices to demonstrate understanding of the core ideas.

Student Learning Objectives

New Jersey Student Learning Standards for Science/ NGSS

MS-PS4-1	Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.
MS-PS4-2	Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.
MS-PS4-3	Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.

Enduring Understandings	Essential Questions
• Waves are disturbances that transfer energy • There are various types of waves including mechanical, water, sound, seismic, and light • Wavelengths and frequencies are properties of waves • A wave's speed is affected by the medium through which it travels • Waves transfer its energy through absorption • Reflection is when a wave bounces off a material's surface • Electromagnetic waves can move through matter and space • Visible light is the light humans can see • Light travels at 300,000km/s or 180,000 mi/s • Human eyes convert light into electrical signals • Sound waves are mechanical waves • Sound waves must travel through matter • Properties of sound waves include pitch, speed, and intensity	• What are waves and how are they produced? • How are waves described by their properties? • How do light waves differ from other types of waves? • How do your eyes change light waves into images? • What are some properties of sound waves? • How does the ear help you be able to hear sounds?

Concepts	Formative Assessment
How do the light and sound system in the auditorium work? • A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude. • Describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave. • Graphs and charts can be used to identify patterns in data. • Waves can be described with both qualitative and quantitative thinking. • When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency	***Students who understand the concepts can:*** • Use mathematical representations to describe and/or support scientific conclusions about how the amplitude of a wave is related to the energy in a wave. • Use mathematical representations to describe a simple model. • Develop and use models to describe the movement of waves in various materials. • Integrate qualitative scientific and technical information in written text with that contained in media and visual displays to clarify claims that digitized signals are a more reliable way to encode and transmit information than analog signals are.

(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.
- Waves are reflected, absorbed, or transmitted through various materials.
- A sound wave needs a medium through which it is transmitted.
- Because light can travel through space, it cannot be a matter wave, like sound or water waves.
- The structure of a wave can be modified to serve particular functions by taking into account properties of different materials and how materials can be shaped and used.
- Structures can be designed to use properties of waves to serve particular functions.
- Waves can be used for communication purposes.

Suggested Learning Activities

In this unit of study suggested learning activities would encompass labs, hands on activities, and modeling waves and the electromagnetic spectrum. Activities could include:

- Labs on demonstrating energy causes waves
- Comparing properties of longitudinal and transverse waves
- Using prisms
- Lab on light and interactions with various materials
- Creating sound with various materials
- Create models to demonstrate wave movement

Performance Expectation

Science and Engineering Practices	DCI	Crosscutting Concepts
Using Mathematics and Computational Thinking • Use mathematical representations to describe and/or support scientific conclusions and design solutions. (MS-PS4-1) **Developing and Using Models** • Develop and use a model to describe phenomena. (MS-PS4-2) **Obtaining, Evaluating, and Communicating Information** • Integrate qualitative scientific and technical information in written text with that contained in media and visual displays to clarify claims and findings. (MS-PS4-3)	**PS4.A: Wave Properties** • A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude. (MS-PS4-1) • A sound wave needs a medium through which it is transmitted. (MS-PS4-2) **PS4.B: Electromagnetic Radiation** • When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency (color) of the light. (MS-PS4-2) • The path that light travels can be traced as straight lines, except at surfaces between different transparent materials (e.g., air and water, air and glass) where the light	**Patterns** • Graphs and charts can be used to identify patterns in data. (MS-PS4-1) **Structure and Function** • Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. (MS-PS4-2) • Structures can be designed to serve particular functions. (MS-PS4-3) ***Connections to Engineering, Technology, and Applications of Science*** **Influence of Science, Engineering, and Technology on Society and the Natural World** • Technologies extend the measurement, exploration, modeling, and computational

	path bends. (MS-PS4-2) • A wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media. (MS-PS4-2) • However, because light can travel through space, it cannot be a matter wave, like sound or water waves. (MS-PS4-2) **PS4.C: Information Technologies and Instrumentation** • Digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information. (MS-PS4-3)	capacity of scientific investigations. (MS-PS4-3) ***Connections to Nature of Science*** **Science is a Human Endeavor** • Advances in technology influence the progress of science and science has influenced advances in technology. (MS-PS4-3)

Cross-Curricular Connections	
English/Language Arts Standards	**Mathematics Standards**
• Cite specific textual evidence to support analysis of science and technical texts. (MS-PS4-3) **RST.6-8.1** • Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions. (MS-PS4-3**) RST.6-8.2** • Compare and contrast the information gained from experiments, simulations, videos, or multimedia sources with that gained from reading a text on the same topic. (MS-PS4-3) **RST.6-8.9** • Draw evidence from informational texts to support analysis, reflection, and research. (MS-PS4-3) **WHST.6-8.9** • Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-PS4-1),(MS-PS4-2) **SL.8.5**	• Reason abstractly and quantitatively. (MS-PS4-1) MP.2 • Model with mathematics. (MS-PS4-1) **MP.4** • Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. (MS-PS4-1) **6.RP.A.1** • Use ratio and rate reasoning to solve real-world and mathematical problems. (MS-PS4-1) **6.RP.A.3** • Recognize and represent proportional relationships between quantities. (MS-PS4-1) **7.RP.A.2** • Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. (MS-PS4-1) **8.F.A.3**

21st Century Career Ready Practices

9.2 Career Awareness, Exploration, and Preparation

- This standard outlines the importance of being knowledgeable about one's interests and talents, and being well informed about postsecondary and career options, career planning, and career requirements.

9.3 Career and Technical Education

- This standard outlines what students should know and be able to do upon completion of a CTE Program of Study.

Grade 6 - Science

Unit 8: Matter and Interactions | Instructional Days:25 Days

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

New Jersey Student Learning Standards for Science/ NGSS

MS-PS1-1	Develop models to describe the atomic composition of simple molecules and extended structures.
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.
MS-PS1-4	Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.
MS-PS1-5	Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.

Enduring Understandings	Essential Questions
• Students will understand that all objects and substances are composed of matter with physical and chemical properties. • Students will understand that matter can change form or state but matter will always be conserved. • Students will understand that matter will combine to form different substances. • Students will understand that all matter is composed of atoms, the basic unit of matter.	• What is the relationship among atoms, elements, and compounds? • How do mixtures and compounds differ? • Where are protons, neutrons, and electrons located in an atom? • How are physical changes different from chemical changes? • How do physical and chemical changes affect mass?

Concepts	Formative Assessment
• 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). • 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.	***Students who understand the concepts are able to:*** • 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 • 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 • 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.

• The law of conservation of mass is a mathematical description of natural phenomena	

Suggested Learning Activities

In this unit of study suggested learning activities would encompass labs, hands on activities, and creating models. Activities could include:

- Modeling the atom with the subatomic particles
- Lab activities demonstrating conservation of mass
- Lab activities demonstrating change in state

Performance Expectation

Science and Engineering Practices	DCI	Crosscutting Concepts
Developing and Using Models • Develop a model to predict and/or describe phenomena. (MS-PS1-1) • Develop a model to predict and/or describe phenomena. (MS-PS1-4) • Develop a model to describe unobservable mechanisms. (MS-PS1-5) • Analyzing and Interpreting Data • Analyze and interpret data to determine similarities and differences in findings. (MS-PS1- 2)	**PS1.A: Structure and Properties of Matter** • Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. (MSPS1-1) • 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) • 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) **PS1.B: Chemical Reactions** • Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. (MS-PS1-2) • 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	**Scale, Proportion, and Quantity** • Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (MS-PS1-1) **Patterns** • Macroscopic patterns are related to the nature of microscopic and atomic-level structure. (MSPS1-2) - **Connections to Nature of Science Scientific Knowledge is Based on Empirical Evidence** • Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-PS1-2) **Cause and Effect** • Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS1-4) **Energy and Matter** • Matter is conserved because atoms are conserved in physical and chemical processes. (MS-PS1-5) • Connections to Nature of Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena • Laws are regularities or mathematical descriptions of natural phenomena. (MS-PS1-5)

	new substances have different properties from those of the reactants. (MS-PS1-5) • The total number of each type of atom is conserved, and thus the mass does not change. (MS-PS1-5)	

Cross-Curricular Connections

English/Language Arts Standards	Mathematics Standards
• 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** • 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** • 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**	• Reason abstractly and quantitatively. (MS-PS1-1),(MS-PS1-2) **MP.2** • Model with mathematics. (MS-PS1-1) MP.4 • Use ratio and rate reasoning to solve real-world and mathematical problems. (MS-PS1-1),(MS-PS1-2) **6.RP.A.3** • Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. (MS-PS1-1) **8.EE.A.3** • Display numerical data in plots on a number line, including dot plots, histograms, and box plots. (MS-PS1-2) 6.SP.B.4 • Summarize numerical data sets in relation to their context. (MS-PS1-2) **6.SP.B.5**

21st Century Career Ready Practices

9.2 Career Awareness, Exploration, and Preparation

- This standard outlines the importance of being knowledgeable about one's interests and talents, and being well informed about postsecondary and career options, career planning, and career requirements.

9.3 Career and Technical Education

- This standard outlines what students should know and be able to do upon completion of a CTE Program of Study.