Bloomingdale School District

Bloomingdale, NJ

Adopted: September

Science

Grades 5-8

2017

Grades 5-8 Science is aligned to the NJSLS-S which are correlated to the NJSLS-ELA and NJSLS-M. There is a focus on learning science through investigation and through reading non-fiction texts and inquiry-based science exploration.

Science Department

Bloomingdale School District

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METHODS OF INSTRUCTION

I. INQUIRY METHOD OR HANDS-ON INVESTIGATIONS

II DEMONSTRATIONS PERFORMED BY THE TEACHER AND/OR STUDENT

III LECTURE

IV CLASS DISCUSSION

V. LAB MANUAL AND/OR TEACHER MADE SHEET ASSIGNMENTS

MATERIALS FOR INSTRUCTION

I. CHALKBOARDS, SMART BOARDS, BULLETIN BOARDS

II. AUDIO-VISUAL AIDS INCLUDING FILMS, ACTIVITY VIDEOS, SLIDES, AND TRANSPARENCIES

III. TEXTBOOK AND LAB MANUALS

IV. SCIENCE EQUIPMENT KITS /FOSS MATERIALS/MODULES

V. COMPUTERS

METHODS OF STUDENT EVALUATION

Teacher observation analysis of:

I. BEHAVIOR DURING HANDS-ON ACTIVITIES

II. EFFORT, SERIOUSNESS OF PURPOSE, PROPER USE OF EQUIPMENT, ATTITUDE IN GROUP

III. PARTICIPATION IN LEARNING CENTERS OR LAB INVESTIGATIONS

- A. Class discussions
- B. Problem-solving sessions

C. Technology software (practice and assessment, internet, data wonders)

IV. LABORATORY WORK
- A. Safety is followed at all times
- B. Organized materials in desk area

V. LABORATORY MANUALS AND/ OR LAB REPORTS

- A. Organization of data/graphing of data if necessary
- B. Communication of data is clear
- C. Development of logical conclusions

VI. HOMEWORK

VII. TESTS AND QUIZZES

VIII. BENCHMARK ASSESSMENTS

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Science Department

5th GRADE SCIENCE **FOSS Measurement and** **NJCTL Matter and Its Interactions (Properties of Matter)**

Unit 1: STUDENTS WILL BE ABLE TO:

- Children will be able to define Matter as a term that applies to all of the stuff around us and it is made of particles that are too small to see.
- Students develop an understanding of the idea that regardless of the type of change that matter undergoes, the total weight of matter is conserved.
- Children will classify the properties of common mater as solid, liquid and gas.

- Children will be able to make observations and measurements to identify materials based on their properties of matter.
- Children will be able to measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved.

- Students will be able to define matter is a term that applies to all of the stuff around us and it is made of particles that are too small to see.

- Children will understand the necessity for standard units of measurement.
- Children will develop an understanding and intuitive feel for the metric system.
- Children will measure length and distance in meters and centimeters with a meter tape.
- Children will measure mass in grams with a balance and mass pieces.
- Children will measure liquid volume and capacity of containers in liters and milliliters with 50-ml syringes and graduated cylinders.
- Children will measure temperature of liquids and air in degrees Celsius with a thermometer.
- Children will acquire the vocabulary associated with metric measurement.
- Children will use scientific thinking processes to conduct investigations and build explanations: observing, communicating, comparing, and organizing.
- Use scientific thinking processes to conduct investigations and build explanations: observing, communicating, comparing, organizing, relating, and inferring.

Scientific and Engineering Practices (SP/EP)

●Asking questions (SP)/ Defining problems (EP)
●Developing and using models
●Planning and carrying out investigations
●Analyzing and Interpreting data Constructing explanations (SP)
●Using mathematics and comp. thinking
●Constructing explanations (SP)/Designing solutions (EP)
●Engaging in argument from evidence
●Obtaining, evaluating, and communicating information

Overview of FOSS Measurement Module and NJCTL Matter and Its Interactions (Properties of Matter)			
Instructional Objectives	Subject Matter Content	NGSS Standards	Activities

Investigation 1: What is Matter? How Long is it? • Students define matter and learn that matter can be measured. • Measure distance in standard metric units. Students will create a standard meter tape. • Use tools to gather data and mathematics to organize data. Identify the Metric System and how it works. • Students learn the need for standard units of linear measurement. Students measure and compare body dimensions, and other matter in the metric system. Students practice long distance measurement by creating planes and measuring their distance. • Engineers plan designs, select materials, construct products, evaluate results, and improve ideas.	• Matter is a term that applies to all of the stuff around us and it is made of particles that are too small to see. • Common matter is solid, liquid, and gas. • Solid matter has definite shape. • Liquid matter has definite volume. • Gas matter has neither definite shape nor volume and expands to fill containers. • Intrinsic properties of matter can be used to organize objects (e.g., color, shape). • Solids interact with water in various ways: float, sink, dissolve, swell, and change. • Liquids interact with water in various ways: layer, mix, change color cooled. • The meter (m) is the standard metric unit of linear measurement; the Centimeter (cm) is 0.01 m. • Length is how far it is from one point to another. Matter is a term that applies to all of the stuff around us and it is made of particles that are too small to see. • The distance from side to side, a dimension usually	• Measurements of a variety of properties can be used to identify materials. (5-PS1-3) • Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model showing that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects. (5-PS1-1) Model with mathematics. **(5-PS1-1)**,(5-PS1-2), (5-PS1-3) 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-PS1-1)** 3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are	•Students define matter and name the 3 states of matter. They make observations and measurements to identify materials based on their properties. • Students create a standard meter tape. They estimate, then measure a variety of objects using the metric system and record their findings in grams. Students find the difference between their predictions and the actual length. • They organize information on a record sheet and measure objects. Compare the results of several linear measurements. • Students create different airplanes using controlled variables. They fly them and measure them using metric measurements. They will plan, construct, evaluate and improve their planes to compete to see who can create the plane that can fly the furthest. They will communicate findings of their planes and the variables that worked.

	shorter than the length is width. • The meter is the basic unit of length in the metric system.	considered to identify aspects of a model or prototype that can be improved. Scientific and Engineering Practices(SP/EP) ●Asking questions (SP)/ Defining problems(EP) ●Developing and using models ●Planning and carrying out investigations ●Analyzing and Interpreting data Constructing explanations(SP) ●Using mathematics and comp. thinking ●Constructing explanations (SP)/Designing solutions (EP) ●Engaging in argument from evidence ●Obtaining, evaluating, and communicating information	
Investigation 2: Weight Watching/ Measuring solid matter. • Students learn the need for standard units for measuring mass and use the FOSS balance and mass pieces to weigh objects. • Students prepare 100-g bags of gravel and cooperate to make a kilogram mass piece.	• The gram (g) is the standard metric unit of mass; the kilogram (kg) is 1000 g. • Mass is the amount of matter in an object and can be determined by weighing an object. • The basic unit of <u>mass</u> in the metric system is a gram. • How much matter is inside of an object is mass. • A characteristic of something: smell, taste color, texture or	• Measurements of a variety of properties can be used to identify materials. (5-PS1-3) Scientific and Engineering Practices(SP/EP) ●Asking questions (SP)/ Defining problems(EP) ●Developing and using models ●Planning and carrying out investigations ●Analyzing and Interpreting data Constructing explanations(SP) ●Using mathematics and comp. thinking	•Students estimate, then weigh a variety of objects using mass pieces and record their findings in grams. Students find the difference between their predictions and the actual mass. • Students try to weigh an object a grapefruit that weighs more than their gram pieces. They communicate a problem, design, and try to reach a solution. • Students create a kilogram out of gravel.

	measurements are properties of matter. • A tool for measuring the mass of an object is a balance. • A kilogram is equal to 1,000 grams or the mass of one liter of water.	●Constructing explanations (SP)/Designing solutions (EP) ●Engaging in argument from evidence ●Obtaining, evaluating, and communicating information Scale, Proportion, and Quantity ●Standard units are used to measure and describe physical quantities such as weight and volume. (5-ESS2-2) Systems and System Models	
Investigation 3: TAKE ME TO YOUR LITER- <u>Measuring Liquid Matter</u> • Students learn the need for standard units of volume. They use syringes and graduated cylinders calibrated in milliliters to measure fluids accurately. After learning how to use the FOSS volume measuring tools, students measure the capacity (maximum volume) of several common containers. •Students will attempt to make clay float.	• Liquid matter has definite volume. The liter (L) is the standard metric unit of fluid measurement; the milliliter (ml) is 0.001 liter. • Volume is the three-dimensional space occupied by something. • Capacity is the maximum amount (or volume) of fluid a container can hold. • A Syringe is used to transfer liquids from one place to another. A syringe is used to measure liquid matter. • Solids interact with water in various ways: float, sink, dissolve, swell, or change.	Measurements of a variety of properties can be used to identify materials. (5-PS1-3) Scientific and Engineering Practices(SP/EP) ●Asking questions (SP)/ Defining problems(EP) ●Developing and using models ●Planning and carrying out investigations ●Analyzing and Interpreting data Constructing explanations(SP) ●Using mathematics and comp. thinking ●Constructing explanations (SP)/Designing solutions (EP) ●Engaging in argument from evidence ●Obtaining, evaluating, and communicating information	• Students observe estimate and measure fluid capacity in milliliters. • Organize information on a record sheet. • Compare measured capacity results to given values. Communicate findings. • Students will read FOSS story about Archimedes and conduct float or sink tests. • Students will create clay boats and measure the displacement of the objects when it looks or sinks. Students attempt to make clay float in a small glass.

		Recognize volume as an attribute of solid figures and understand concepts of volume measurement. **(5-PS1-1)** Scale, Proportion, and Quantity Standard units are used to measure and describe physical quantities such as weight and volume. (5-ESS2-2) Systems and System Models	
Temperature Investigations • Children will measure temperature of liquids and air in degrees Celsius with a thermometer. Students will get an understanding of Celsius and Fahrenheit Scales.	• A measure of how hot or cold something is temperature. • Substances change state (e.g., melt or freeze) when heated or • Heat is energy. Heat flows from warm to cold. • Degree Celsius (C) is the basic unit of temperature in the metric system.	Measurements of a variety of properties can be used to identify materials. (5-PS1-3) Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real-world problems. **(5-PS1-2)** 5.MD.A.1	• Students will take the daily temperature of the classroom in degrees Celsius and degree Fahrenheit. • Students will identify the boiling points and freezing points of the Celsius Scale and Fahrenheit. • Students will conduct "Cooling OFF Experiment using ice and see the ice cubes change states of matter. • Students will convert Celsius temperatures into Fahrenheit temperatures.

5th Grade Science FOSS Landforms Modules and NJTCL Earth's Systems

Unit 2: STUDENTS WILL BE ABLE TO:

● Students are able to describe and explain the w four major systems of the Earth (the geosphere, biosphere, hydrosphere, and/or atmosphere) interact.
● Differentiate between the different layers of the Earth based on distinct characteristics.
● Explain the relationship between plants and animals when it comes to the production of oxygen and carbon dioxide.
● Describe how life on Earth would be different if the ozone layer continues to be depleted.

Interpret and create graphs that represent the location of both salt and fresh water on Earth.
• Students will be able to describe the vast majority of water on Earth is salt water and unusable. Most of the water that is usable is trapped in glaciers.
• Students will be able to explain how much water can be found in different places on Earth.
• Analyze lab results that suggest that areas near water will see milder temperature fluctuations than areas that are further inland.
•Children will gain experience with the concepts of erosion and deposition.
• Children will observe the effect of water on surface features of the land, using stream tables.
• Children will plan and conduct stream-table investigations.
• Children will relate processes that they observe in the stream-table models to processes that created famous landforms.
• Students will be able to describe volcanoes, tectonic plates and how earthquakes impact the earth.
• Students will be able to build and define an earth quake house. Students will be able to test their engineering design on the Shake Table to determine if the house would survive an earthquake.
•Use scientific thinking processes to conduct investigations and build explanations: observing, communicating, comparing, organizing, relating, and inferring.
• Scientific and Engineering Practices (SP/EP)
●Asking questions (SP)/ Defining problems (EP)
●Developing and using models
●Planning and carrying out investigations
●Analyzing and Interpreting data Constructing explanations (SP)
●Using mathematics and comp. thinking
●Constructing explanations (SP)/Designing solutions (EP)
●Engaging in argument from evidence
●Obtaining, evaluating, and communicating information

Overview of **FOSS Landforms Modules and NJTCL Earth's Systems**			
Instructional Objectives	Subject Matter Content	NGSS Standards	Activities
Investigation 1: Major Systems of the Earth. •Students will list the four major systems that make up our Earth and describe how they interact? •Students will draw the four layers of the Earth and determine	•Earth is a nonliving object that is made up of four major systems: the Geosphere, Atmosphere, Hydrosphere and the Biosphere. •The Earth's geosphere is composed of four distinct layers: the crust, mantle, core and inner core. • The prefix geo means	**ESS2.A: Earth Materials and Systems** • Earth's major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in	Students will read and discover more about the four major systems of the Earth. Students will watch multimedia videos. Students will draw diagrams of the systems, explaining the parts of the Geosphere, Atmosphere,

the characteristics of each.	"earth". The geosphere is the system that includes the rocks, minerals and landforms that shape Earth. • Life on Earth relies on a layer of the geosphere called soil. Soil is the topmost layer of Earth in which plants grow. It is made up of mixture of organic remains (objects that once were living things), clay, and rock particles. Without the soil in the geosphere, there would be no *biosphere*. • The atmosphere is a mixture of gases surrounding Earth. The prefix "atmo" comes from a Greek word meaning "gas" or "vapor". • The prefix "Hydro" means "water" or "liquid". The hydrosphere describes the combined mass of water found on, under, and over the surface of a planet. It includes water in all three states. • "Bio" is a Greek prefix that means "life". It includes all living things on Earth as well as the land, sea and atmosphere in which they live.	multiple ways to affect Earth's surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather. (5-ESS2-1) **ESS2.C: The Roles of Water in Earth's Surface Processes** •Nearly all of Earth's available water is in the ocean. Most fresh water is in glaciers or underground; only a tiny fraction is in streams, **RI.5.7** 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-PS3-1) **SL.5.5** Include multimedia	Hydrosphere and the Biosphere.
Investigation 2: **Atmosphere and Water on Earth** **How much water can be found in different places on Earth?**	• The vast majority of water on Earth is salt water and unusable. Most of the water that is usable is trapped in glaciers.	**Nearly all of Earth's available water is in the ocean. Most fresh water is in glaciers or underground; only a tiny fraction is in streams, lakes,**	•Students will draw out the layers of the Earth's Atmosphere and label what occurs in each layer. •Students will view photos of where all

• Students will identify the components of our atmosphere and how the atmosphere is affected by animals and plants. •Students will describe where the water on Earth located and how much of this water is usable by humans. •Students will identify the affect ocean water has on the nearby land.	• Of all the water on Earth, 97.5% is contained within the oceans (saltwater). Only 2.5% of Earth's water is fresh. This means that only 2.5% of all water on Earth is usable for drinking, cooking, washing and other purposes. • Glaciers are large bodies of thick ice that are found primarily near the North and South poles, such as in Antarctica and Greenland. Nearly 69% of Earth's fresh water is trapped in glaciers • Areas that are near water will have milder climate changes because the ocean will slowly absorb and release heat. • Just like the geosphere, the atmosphere is also divided into layers(Troposphere, Stratosphere, Mesosphere, Thermosphere and the Exosphere). As you get higher in the atmosphere, the amount of pressure and temperature decreases. • The ozone layer protects animals and plants from getting too much of the Sun's dangerous ultraviolet (UV)rays.	**wetlands, and the atmosphere. (5-ESS2-2)** **RI.5.7** 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-PS3-1) **SL.5.5** Include multimedia	the water on Earth is found. They will graph, draw and chart out where all usable water is on the planet. •Students will read about main rivers in the world, glaciers and oceans. Students will view videos on glaciers, rivers and erosion.
Investigation 3 Stream Tables , Water on Earth and creation of Landforms:	• Water is an important agent in shaping landforms. •The wearing away of earth is erosion;	**These systems interact in multiple ways to affect Earth's surface materials and processes. The**	• Students will use stream tables to create landforms. Students will identify different landforms that were

•Students will investigate water flow over earth materials in a stream table. They will observe the process of erosion, deposition, and stream flow. • Students will relate the stream tables to the creation of the Grand Canyon.	the settling of eroded material is deposition. •Landforms that result from running water include canyons, deltas, and alluvial fans. • The slope of the land over which a river flows affects the processes of erosion and deposition. • During flooding, the rate of erosion and deposition increases. • Humans affect the processes of erosion and deposition. • A shape of the earth's surface is a landform. • Deposition is when eroded earth materials settle in another place • A dam is a construction or wall across a river that holds back the water flowing through the river, creating a reservoir or a lake. • A tributary is a stream flowing into another stream or river. • A Levee is a natural or artificial wall of earth material along a river or sea that keeps the land from flooding.	**ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather. (5-ESS2-1)** **Scientific and Engineering Practices(SP/EP)** ●Asking questions (SP)/ Defining problems(EP) ●Developing and using models ●Planning and carrying out investigations ●Analyzing and Interpreting data Constructing explanations(SP) ●Using mathematics and comp. thinking ●Constructing explanations (SP)/Designing solutions (EP) ●Engaging in argument from evidence ●Obtaining, evaluating, and communicating information • Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments. (5-ESS3-1)	created including canyons, meanders, mountains, plateaus, plains, deltas, alluvial fans and flood plains. • Students will create a model of the Grand Canyon in their stream tables. • Students will place stream tables on a slope and view differences in the flow of the water. • Students will manipulate the stream tables to create a flash floods and beaches • Students will attempt to make a town that can sustain the erosion in their stream table by building a dam or a levee. Students will plan and construct a working dam or levee. They will analyze and communicate their findings. • Students will view and reflect on videos on erosion and landforms. **Landform FOSS Reading Articles will be incorporated**

		RI.5.7 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-PS3-1) **SL.5.5** Include multimedia	
Investigation 4: Earthquakes and Volcanoes • Students will identify different types of volcanoes and learn about earthquakes. Students will plan, design and construct earthquake houses that will be tested on a shake table. • Engineers plan designs, select materials, construct products, evaluate results, and improve ideas.	• Tectonic Plates: The Earth's surface is made up of a series of large plates called Tectonic Plates (like pieces of a giant jigsaw puzzle they make up the Crust). • **Pangaea** (meaning *entire)* was the super continent that existed about 250 million years ago. • The Ring of Fire has 452 volcanoes and is home to over 50% of the world's active and dormant volcanoes. • A volcano is a vent where magma from Earth's hot interior breaks through the surface. • Places where two plates move past each other are called faults. When plates slide past each other we have an earthquake.	3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved. 5-ESS3-1: Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment. **Scientific and Engineering Practices(SP/EP)** ●Asking questions (SP)/ Defining problems(EP) ●Developing and using models ●Planning and carrying out investigations ●Analyzing and Interpreting data Constructing explanations(SP) ●Using mathematics and comp. thinking ●Constructing explanations (SP)/Designing solutions (EP)	• Students will study the different types of volcanoes. Students will pocket volcanoes • Students will view videos on volcanoes. • Students will create Earthquake houses out of wood that will be tested on a Shake Table to see how long the house would last in an earthquake. Students will learn techniques that engineers use to protect communities and houses from earthquakes. ●Students will investigate with the idea of Pangaea by cutting up a world map and trying to piece the supercontinent back together. **Landform FOSS Reading Articles will be incorporated**

		●Engaging in argument from evidence ●Obtaining, evaluating, and communicating information	

5th Grade Science **NJTCL Human Impacts**

Unit 3: STUDENTS WILL BE ABLE TO

- Define how humans negatively impact Earth systems and how humans positively impact Earth systems.
- Describe humans' impact on Earth systems
- Explain the impact that increasing human populations have on natural resources.
- Identify changes humans can make to lessen their impact on the Earth's systems.
- Use scientific thinking processes to conduct investigations and build explanations: observing, communicating, comparing, organizing, relating, and inferring.

Overview of	**NJCTL Human Impacts**		
Instructional Objectives	Subject Matter Content	NGSS Standards	Activities

Investigation 1: Human Impacts and Importance of the Environment • Students will list and describe **Human Impacts and Importance of the Environment**	• For every action there is an equal and opposite reaction. • What impact do humans have on the Earth? • Agriculture provides food and products. In what ways, however, does it impact the Earth.	• Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments. (5-ESS3-1)	• Students will create a running list of ways human impact the world. • Students will view videos on Human Impacts on the world along with read about the impacts we have made. • Students will research and present a project on a human impact of their choice.
Investigation 2: **Negative Human Impacts**	Negative human impacts can be seen in the following areas: · Global warming · Ozone depletion · Water · Land · Pollution · Space debris · Resource depletion · Loss of biodiversity · Population increase · Economic growth · Oil Spills Damaged and destroyed ecosystems The Anthropocene Era would begin in the 1900's and is the age when the effects of increased human population and economic development severely impacted planetary physical, chemical, and biological conditions.	• Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments. (5-ESS3-1)	Students will create a timeline that illustrates the progression of the Anthropocene Era. • Ecological Footprint Activity: How does your footprint compare with others? What can you do to lesson your footprint? • Students will continue to research and present a project on a human impact of their choice.
Investigation 3: Positive Human Impacts • Students upcycle plastic bottles and design and test boats to see how	●The process of recycling involves the reduction, reusing and recycling of what is commonly considered waste.	Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are	• Upcycling Activity What is upcycling? Can you upcycle? Students will take recycled plastic bottles that are deemed not useful and upcycle

many pennies that they can hold. • Students create a fan blade assembly to test for creating wind power. • Students design, create and test balloon powered cars. • Engineers plan designs, select materials, construct products, evaluate results, and improve ideas.	●Many items are useful for more that their intended purpose. Reusing or upcycling items prevents them from ending up in landfill and reduces the amount of items. ●The development and advancement of new technologies have allowed humans to decrease their dependence upon fossil fuels and inefficient methods. Some recent examples of new technologies that are beneficial to both humans and the environment are solar power, wind power, LED light bulbs, and Nanotechnology filtration.	doing things to help protect Earth's resources and environments. (5-ESS3-1) **Scientific and Engineering Practices(SP/EP)** ●Asking questions (SP)/ Defining problems(EP) ●Developing and using models ●Planning and carrying out investigations ●Analyzing and Interpreting data Constructing explanations(SP) ●Using mathematics and comp. thinking ●Constructing explanations (SP)/Designing solutions (EP) ●Engaging in argument from evidence ●Obtaining, evaluating, and communicating information	them creating use a boat that can hold pennies. Students will design and test the upcycled boats to see which boat can hold the most pennies. • Students will plan, test, switch variables and create a fan blade assembly and test it to see which group can create the most wind power generated on a Multi Meter. Students will study how wind and solar power positively affects humans. • Students will collaborate to plan and design a balloon-powered car Students will discover how technology affects society for the good and bad by reading articles

Overview of NJCTL Ecosystem Dynamics, Energy in Organisms and Part of FOSS Food and Nutrition

Unit 4: STUDENTS WILL BE ABLE TO

- All food webs rely on the sun for its energy source and producers to create their own food.
- Energy and mass are transferred from one organism to the next as it is eaten.
- Decomposers take dead material and recycle it back into usable material.
- Ecosystems are very fragile and require a perfect balance of predator and prey.
- Children will be able to explain the importance of producers, consumers and decomposers in an ecosystem.
- Observe and analyze factors that aid decomposition
- Children will be able to conclude that plants get the materials they need for growth chiefly from air, water and the sun.
- Describe the flow of energy and mass through a food web.
- Make conclusions about an ecosystem's chances for survival based on factors such as overpopulation or overhunting.
- Students are introduced to fats in the human diet and conduct a fat search using the brown-paper technique. Equal weights of different food samples are spread on a specific area and allowed to soak into the paper. The area of spread for each food is compared to a sample of 100% fat.

- Use scientific thinking processes to conduct investigations and build explanations: observing, communicating, comparing, organizing, relating, and inferring.

Overview of **<u>NJCTL</u> Ecosystem Dynamics, Energy in Organisms and FOSS Food and Nutrition**			
Instructional Objectives	Subject Matter Content	NGSS Standards	Activities
Energy Introduction: **What is energy, Where do humans get energy from?** • Children will become aware of carbohydrates, proteins, fats, and vitamins as components of food. •Students will be able to identify the Six Main Nutrients needed for good nutrition. •Students will able to identify the importance of fat in a diet and will be able to distinguish from unsaturated fat and saturated fat. Students will be able to explain that fats give humans energy, protect bones and provide warmth.	●**Energy** is the ability to do work. **Energy** comes in different forms: Heat (thermal) Light (radiant) Motion (kinetic) ●Potential energy is stored energy and the energy of position. ●Humans need energy for Body Repair: When cells are damaged, they will repair themselves by using the materials and energy found in food, to create new cells. ●Many organisms use energy to generate heat to maintain their internal temperature. ●Organisms use energy to move their bodies. ●Chemical energy is found in our food. ●Cellular Respiration is the process in our body that releases the energy stored in food for our use. ●Humans and animals are consumers or heterotrophs an organism that obtains energy and matter by feeding on others.	**PS3.D: Energy in Chemical Processes and Everyday Life** • The energy released [from] food was once energy from the sun that was captured by plants in the chemical process that forms plant matter (from air and water). (5-PS3-1) **LS1.C: Organization for Matter and Energy Flow in Organisms** • Food provides animals with the materials they need for body repair and growth and the energy they need to maintain ●Energy can be transferred in various ways and between objects. (5-PS3-1)	•Students will define energy and draw examples of potential energy. ●Students will conduct investigations with common foods to discover fat. Students will conduct fat tests using a brown paper bag. Students will investigate the food that they eat every day. •Students will be able to conduct a fat test on their favorite foods from home. Food and Nutrition FOSS Reading Articles will be incorporated

Digestive System • Children will be able to identify the organs that make up the digestive system and their function. • Develop students' understanding of functions of living systems.	**Food/ Nutrition, The Digestive System** • One of the systems of the human organism is the digestive system. This system interacts with the other systems in the human body. • The process by which food is broken down into a form that the body can use is called digestion. • Villi are the tiny fingerlike organs that line the Small Intestine. They absorb vitamins and nutrients.	**PS3.D: Energy in Chemical Processes and Everyday Life** ● The energy released [from] food was once energy from the sun that was captured by plants in the chemical process that forms plant matter (from air and water). (5-PS3-1) **LS1.C: Organization for Matter and Energy Flow in Organisms** ● Food provides animals with the materials they need for body repair and growth and the energy they need to maintain ● Energy can be transferred in various ways and between objects. (5-PS3-1)	•Students will view pictures of the organs in the Digestive System. •Students will create their own mini diagrams of the Digestive system labeling each organ and its function. •Students will be able to explore the Digestive System virtually. •Students will watch the movie, Magic School Bus, "What's for Lunch" a movie that explores the Digestive System. • Food and Nutrition FOSS Reading Articles will be incorporated
Plant/Seed Investigations • Students will discover that plants need energy too. They will conduct experiments to determine where plants get the energy from and what they need to grow.	• An organism that makes it own food by using the energy from sunlight to produce sugars are called producers or autotrophs. • Plants collect sunlight and turn it into food using a process called **Photosynthesis.** • Photosynthesis is a chemical reaction that requires sunlight,	**PS3.D: Energy in Chemical Processes and Everyday Life** ▭ The energy released [from] food was once energy from the sun that was captured by plants in the chemical process that forms plant matter (from air and water). (5-PS3-1) **LS1.C: Organization for Matter and Energy Flow in Organisms** ● Food provides animals with the materials they need for body repair and	• Students will list and draw producers and autotrophs. • Students will observe corn, barley, grass, radish and other seeds and identify properties of the seeds that will help them germinate. • Students will conduct seed experiments to see if seeds will germinate in sand, on wet cotton balls, in the dark, in a stocking with dirt, in a

	carbon dioxide and water to work. •Plants get the materials they need for growth chiefly from air, water and the sun.	growth and the energy they need to maintain ● Energy can be transferred in various ways and between objects. (5-PS3-1)	CD case and with various other variables • Students will attempt to germinate broken seeds, boiled seeds, seeds in the dark.
Yeast and Sugar Tests • Students will experiment with the decomposer Yeast and observe how Yeast uses sugar for energy, producing CO2.	• Yeast is a fungus that is in a dormant stage. • Yeast will wake up when sugar and heat are present and begin to metabolize and use the sugar for energy, Yeast will create CO2 after it • Decomposers take dead material and recycle it back into usable material.	**PS3.D: Energy in Chemical Processes and Everyday Life** The energy released [from] food was once energy from the sun that was captured by plants in the chemical process that forms plant matter (from air and water). (5-PS3-1) **LS1.C: Organization for Matter and Energy Flow in Organisms** ● Food provides animals with the materials they need for body repair and growth and the energy they need to maintain ● Energy can be transferred in various ways and between objects. (5-PS3-1)	• Children will use indicators to test for sugar in foods. Students will use yeast to see if cookies have sugar in them. • Students will use yeast to determine what cereal contains the most sugar. • Students will use yeast to determine what candies/ snacks have the most sugar. • Students will use a volume tube to test if the yeast metabolized due the presence of sugar using a volume. Students will be able to determine that the Yeast which is a fungi
Building a model of an Ecosystem- Modeling Matter Moving within an Ecosystem by creating a Food Web. •Students will model matter that moves within an ecosystem by creating a food chain and food web.	• All food webs rely on the sun for its energy source and producers to create their own food. • Energy and mass are transferred from one organism to the next as it is eaten. • Decomposers take dead material and recycle it back into usable material. • Ecosystems are very fragile and require a	**PS3.D: Energy in Chemical Processes and Everyday Life** ● The energy released [from] food was once energy from the sun that was captured by plants in the chemical process that forms plant matter (from air and water). (5-PS3-1) **LS1.C: Organization for**	• Students will research and read about environments and biomes including The Tundra, Deciduous Forest, Savannah, Desert and Rainforest. • Students will model energy movement through an ecosystem

	perfect balance of predator and prey. • A habitat is a place where an organism lives and can find everything it needs to survive. • The role that a plant or animal plays in its habitat is called a niche. • Photosynthesis is the process that plants use to make sugar from the sun's light. • All the organisms of the same kind that live together in a given area are called population. • An animal that hunts, catches, and eats other animals is a predator. • Animals called prey are caught and eaten by predators. • A living thing, such as a plant, that can make its own food is called a producer. • A living thing that gets energy by breaking down dead organisms and animal wastes into simpler substances is a decomposer. • The transfer of food energy between organisms in an ecosystem is called a food chain.	**Matter and Energy Flow in Organisms** ● Food provides animals with the materials they need for body repair and growth and the energy they need to maintain **5-PS3-1. Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.** ● Energy can be transferred in various ways and between objects. (5-PS3-1) **LS2.A: Interdependent Relationships in Ecosystems** ● The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as "decomposers." Decomposition eventually restores (recycles) some	creating a food chain then a food web. • Building a model of an Ecosystem- Modeling Matter Moving with thin an Ecosystem by creating a Food Web.

	• A food web is a group of food chains that overlap. • An Organism that is non active to an environment that disrupts the stable web of life is called an invasive species. • An animal that feeds on dead plants and animals is a Scavenger.	materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem. (5-LS2-1) **LS2.B: Cycles of Matter and Energy Transfer in Ecosystems** • Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. Organisms obtain gases, and water, from the environment, and release waste matter (gas, liquid, or solid) back into the environment. (5-LS2-1)	

5th GRADE SCIENCE **FOSS Mixtures and Solutions/NJCTL Matter and Its Interactions (Changes to Matter)**

Unit 5: Students Will Be Able To:

- Children will gain experience with the concepts of a mixture and a solution.
- Children will gain experience with the concepts of concentration and saturation.
- Children will gain experience with the concept of chemical reaction.
- Students determine whether the mixing of two or more substances results in new substances.
- Children will apply an operational definition to determine the relative concentrations of solutions.
- Children will use group problem-solving techniques to plan investigations.
- Children will use measurement in the context of scientific investigations.
- Children will apply mathematics in the context of science.
- Children will acquire vocabulary associated with chemistry and the periodic table.
- Children will be introduced to the concept that all matter is made of very small particles called atoms and that atoms combine to form molecules.
- Children will use scientific thinking processes to conduct investigations and build explanations: observing, communicating, comparing, organizing, and relating.
- Make and separate mixtures, using screens, filters, and evaporation.
- Measure solids and liquids to compare the mass of a mixture to the mass of its parts.
- Use a balance to determine relative concentration. Layer solutions to determine relative density (concentration).
- Plan and conduct saturation investigations. Compare the solubility of substances in water.
- Identify an unknown substance based on the properties of solubility and crystal form.
- Observe and compare reactants and products of several chemical reactions.

- Engineers plan designs, select materials, construct products, evaluate results, and improve ideas.

- **Scientific and Engineering Practices(SP/EP)**

●Asking questions (SP)/ Defining problems (EP)
●Developing and using models
●Planning and carrying out investigations
●Analyzing and Interpreting data Constructing explanations (SP)
●Using mathematics and comp. thinking
●Constructing explanations (SP)/Designing solutions (EP)
●Engaging in argument from evidence
●Obtaining, evaluating, and communicating information

Overview of Mixtures and Solutions FOSS Module/ NJCTL Matter and Its Interactions (Changes to Matter)			
Instructional Objectives	Subject Matter Content	NGSS Standards	Activities
Investigation 1 Separating	• A mixture combines two or more	· 5-PS1 : Matter and Its Interactions	• Students define matter and list

Mixtures and Solutions: • Students make mixtures of water and solid materials and separate the mixtures with screens and filters. They find that water and salt make a special kind of mixture, a solution, which cannot be separated with a filter but only through evaporation. Students are challenged with a problem: how to separate a mixture of three dry solid materials. The investigation concludes with students going outdoors to see what natural materials make solutions with water. • Identify the differences between soluble and insoluble solutions.	materials that retain their own properties. • A solution forms when a material dissolves in a liquid (solvent) and cannot be retrieved with a filter. • Soluble objects will dissolve in a liquid forming a solution. • Evaporation can separate a liquid from a solid in a solution. • The solid material separated by evaporation from a solution forms distinctive crystal patterns. • Matter is made of atoms. • Substances are defined by chemical formulas. • Elements are defined by unique atoms. • The properties of matter are determined by the kinds and behaviors of its atoms.	5-PS1-1. : Develop a model to describe that matter is made of particles too small to be seen. [Clarification Statement: Examples of evidence could include adding air to expand a basketball, compressing air in a syringe, dissolving sugar in water, and evaporating salt water.] • • 5-PS1-2: Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved. [Clarification Statement: Examples of reactions or changes could include phase changes, dissolving, and mixing that form new substances.] • • • 5-PS1-3: Make observations and measurements to identify materials based on their properties. [Clarification Statement: Examples of materials to be identified could include baking soda and other powders, metals,	properties of certain objects. •Students will conduct soluble and insoluble experiments by dropping certain objects (sugar, baking soda, salt, paper, toilet paper, popcorn and other chemicals) into water and leaving them over night to see if they fully dissolve. • Students make mixtures of water and solid materials (salt, gravel, and diatomaceous earth) and separate the mixtures with screens and filters. • They find that water and salt make a special kind of mixture, a solution that cannot be separated with a filter but only through evaporation.

	• Atomic theory explains the conservation of matter.	minerals, and liquids. Examples of properties could include color, hardness, reflectivity, electrical conductivity, thermal conductivity, response to magnetic forces, and solubility; density is not intended as an identifiable property.] . **Scientific and Engineering Practices(SP/EP)** ●Asking questions (SP)/ Defining problems(EP) ●Developing and using models ●Planning and carrying out investigations ●Analyzing and Interpreting data Constructing explanations(SP) ●Using mathematics and comp. thinking ●Constructing explanations (SP)/Designing solutions (EP) ●Engaging in argument from evidence ●Obtaining, evaluating, and communicating information	• Students will be able to see if the process of evaporation will work with salt and water. • Students conduct various evaporation experiments and make crystals. •Students will watch Bill Nye's video, The Water Cycle. Students will draw and label the parts of the Water Cycle. • Students will be able to test if saltwater in a closet will evaporate, if food coloring will evaporate with the water and if the saltwater will evaporate quicker if it the sun. • Students will be able to observe the crystal formations left behind by the dissolved salt. •Students will use lemon

			juice and the process of evaporation to conduct a mystery message experiment. • Students evaluate the Periodic Table of Elements, reviewing one element a day. FOS Science Resources Book "Mixtures" "Taking Mixtures Apart" "The Story of Salt"
Investigation 2: **Concentration** •Students will be able to identify drinks that are diluted and concentrated. • Children will apply an operational definition to determine the relative concentrations of solutions. • Children will use group problem-solving techniques to plan investigations	• When equal volumes of two solutions made from the same ingredients are compared, the heavier one is the more concentrated solution. • Concentration expresses a relationship between the amount of dissolved material and the volume of solvent. • The more material dissolved in a liquid, the	5-PS1-3: Make observations and measurements to identify materials based on their properties. [Clarification Statement: Examples of materials to be identified could include baking soda and other powders, metals, minerals, and liquids. Examples of properties could include color, hardness, reflectivity, electrical conductivity, thermal conductivity, response to magnetic forces, and solubility; density is not intended as an identifiable property.] . **Scientific and Engineering Practices(SP/EP)** ●Asking questions (SP)/ Defining problems(EP) ●Developing and using models ●Planning and carrying out investigations ●Analyzing and Interpreting data Constructing explanations(SP) ●Using mathematics and comp. thinking ●Constructing explanations (SP)/Designing solutions (EP) ●Engaging in argument from evidence ●Obtaining, evaluating, and communicating information	• Students observe and compare soft-drink solutions that differ in the amount of powder (water held constant) and that differ in the amount of water (powder held constant) to develop the concept of concentration. • They make salt solutions of different concentrations and compare them, using a balance. They

	more concentrated the solution. • A concentrated solution can be made more dilute by adding solvent to the solution. • During dissolving, one substance is reduced to particles (solute), which are distributed uniformly throughout the particles of the other substance (solvent).		determine the relative concentrations of three mystery solutions made from the same solid material. Science Resources Book "The Bends" "Sour Power"
Investigation 3, Reaching Saturation: •Students will be able to experiment with saturated solutions. •Students will be able to study the gases that are present in our atmosphere. Students make a saturated solution by adding salt to water until no more salt will dissolve. They also make a	• A solution is saturated when as much solid material as possible has dissolved in the liquid. • The Earth's atmosphere is made up different layers, including the Troposphere, Stratosphere, Mesosphere, Thermosphere and Exosphere.	**No matter what reaction or change in properties occurs, the total weight of the substances does not change. (5-PS1-2)** **Scientific and Engineering Practices(SP/EP)** ●Asking questions (SP)/ Defining problems(EP) ●Developing and using models ●Planning and carrying out investigations ●Analyzing and Interpreting data Constructing explanations(SP) ●Using mathematics and comp. thinking ●Constructing explanations (SP)/Designing solutions (EP) ●Engaging in argument from evidence ●Obtaining, evaluating, and communicating information	• Students make a saturated solution by adding salt to water until no more salt will dissolve. • Students also make a saturated Citric Acid solution. Using a balance, they compare the solubility of the two solid materials by comparing the mass of the salt and citric acid dissolved

saturated Epsom salts solution. Using a balance, they compare the solubility of the two solid materials by comparing the mass of the salt and Epsom salts dissolved in the saturated solutions. Students use the property of solubility to identify an unknown material.			in the saturated solutions. • They use the property of solubility to identify two unknown or mystery materials. • Students create and taste a diluted cup of ice tea, a concentrated cup and a saturated cup of ice tea.
Investigation 4: **Chemical Reactions** **Can new substances be created by combining other substances?** • Students make three solutions with water, calcium chloride, baking soda, and citric acid. They systematically mix pairs of those solutions and observe changes that occur. The changes (formation of a gas and a white	• Some mixtures result in a chemical reaction. • During reactions, starting substances (reactants) change into new substances (products). • A gas or precipitate is evidence of a reaction. • Some products of reactions are soluble and can be identified by crystal	5-PS1-4: Conduct an investigation to determine whether the mixing of two or more substances results in new substances. **When two or more different substances are mixed, a new substance with different properties may be formed. (5-PS1-4)** **Scientific and Engineering Practices(SP/EP)** ●Asking questions (SP)/ Defining problems(EP) ●Developing and using models ●Planning and carrying out investigations ●Analyzing and Interpreting data Constructing explanations(SP) ●Using mathematics and comp. thinking ●Constructing explanations (SP)/Designing solutions (EP) ●Engaging in argument from evidence ●Obtaining, evaluating, and communicating information	• Students will mix chemicals (calcium chloride, baking soda, and citric acid) together and see if a chemical reaction occurs. •Students will mix chemicals in a zip lock bags to see if the reactions differ. •Students will create the precipitate chalk. Students will try to identify the mystery

precipitate) are identified as evidence of a chemical reaction. Students repeat the reactions in sealed zip bags to observe the volume of gas produced. They analyze local water samples, using separation techniques. • Students will observe that acid and baking soda react to form carbon dioxide. Students will be able to use the indicator baking soda to test for acid in different juices and see which juices form a chemical reaction.	structure after evaporation. • During chemical reactions, particles in the Reactants rearrange to form new products. • Energy transfer to/from the particles in a substance can result in phase change. •Sometimes when two substances are mixed, each of the substances keeps its original properties and sometimes a new substance is formed. • Students use baking soda as an indicator of acid. In a closed system, the volume of gas produced by the acid/baking soda reaction is related to the concentration of acid in the sample. Students will see if a chemical reaction occurs in reaction bottles		precipitate that they have created •Students will create chemical reactions- skate board mini rockets •Student will mix glue, water, borax and other chemicals to create a chemical reaction / Slime. •Students will create a chemical reaction and precipitate: play dough. • Students will test different juices, drinks, and chemicals to see if they react with baking soda.

Unit 6: 5th GRADE SCIENCE **NJCTL Earth's Place in the Universe**

- Children will gain experience with the concepts of space, stars and the universe.
- Children will conclude that a star's distance from Earth affects how bright it appears to be.
- Children will measure the length of shadows at certain times and conclude that the length of shadows decrease during the day until they reach a certain point, then the shadows gradual start to get larger.
- Children will discover in luminosity labs that the rotation of Earth causes night and day.

- Children will read about constellations and create them. They will conclude that the location of constellations change due to the rotation and revolution of Earth.

Overview of NJCTL Earth's Place in the Universe			
Instructional Objectives	Subject Matter Content	NGSS Standards	Activities
Investigations: **Luminosity Labs** • Students will compare the brightness of the Sun compared to other stars • Students will experiment and conclude what causes day and night. • Students will measure the shadow of a common object during different times of the day and conclude why they differ.	• The Universe includes living things, planets, stars, and galaxies. • A galaxy is a collection of stars, gas, and dust bound together by gravity. The Universe contains billions of galaxies, each containing millions or even billions of stars. • Our Sun is not unique in the universe. It is a common, medium sized yellow star which scientists have named Sol, after the ancient Roman name. This is why our system of planets is called the Solar System. • There are many stars that are much bigger than the sun. • The sun appears so much larger and brighter than the other stars we usually see in the sky because we are	**ESS1.A: The Universe and its Stars** • 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. (5-ESS1-1) **ESS1.B: Earth and the Solar System** • 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; and different positions of the sun, moon, and stars	• **Luminosity Lab** Create an argument that relative brightness of the Sun compared to other stars is a function of the distance to those stars. • Explain how day turns into night using a light bulb and a globe. • Explain why the sun casts different sized shadows by measuring the shadows of common objects created and comparing them to shadows from a different class at different time.

	so close to it. The sun is not the brightest star but it is the closest one to us. • As the Earth rotates, only the side facing the Sun is in daylight. • A shadow is the absence of light. When an object blocks light, it creates a shadow.		
Constellations • Students will identify constellations and the role they played in the past.	• The ancient Greeks looked at the sky and imagined pictures in the star Formations. We call these constellations. • A constellation is a group of stars. Each point in a constellation is composed of an individual star. • The location of constellations change due to the rotation and revolution of Earth. These were used to determine seasons, for farming and calendars of the past.	**ESS1.A: The Universe and its Stars** · 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. (5-ESS1-1) **ESS1.B: Earth and the Solar System** · 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; and different positions of the sun, moon, and stars	• Explain that the location of constellation in the night sky appear in different locations due to the rotation and revolution of Earth. • Students will view different constellations in the sky. Students will read about constellations and create constellations out of marshmallows and pretzels.

*Time permitting, students will end the year with **FOSS Module Variables** where they will be able to follow **Scientific and Engineering Practices and build pendulums, FOSS Planes and catapults.**

Bloomingdale School District

Bloomingdale, NJ

Adopted: September

Science
Grade 6

2015

Grades 6 Science is aligned to the NJSLS-S which are correlated to the NJSLS-ELA and NJSLS-M. There is a focus on learning science through investigation and through reading non-fiction texts and inquiry-based science exploration.

Science Department

6th GRADE SCIENCE **Force and Motion**

STUDENTS WILL BE ABLE TO:

- Observe and describe an object's motion in terms of change of position.
- Explain how to use a reference point to determine the distance moved by an object.
- Use tools to gather data and mathematics to organize and analyze data.
- Explain speed in terms of distance and time and use speed graphs to determine head starts.
- Transform narrative accounts of motion events into graphic representations.
- Explain the difference between displacement and distance.
- Conduct experiments to acquire distance or displacement and time data to determine speed, velocity, and acceleration.
- Use tools (pushers, spring scales, and multimedia simulations) to apply force and to investigate force and motion.
- Analyze illustrations of forces in motion.
- Describe change of motion as a result of net force.
- Determine the relationship between mass and the force of gravity using spring scales, and explain gravity as a universal force.
- Explain and apply the interplay of force and time (impulse) and momentum in crashes.
- Acquire vocabulary concerning these concepts: position, distance, displacement, speed, velocity, acceleration, motion, force, gravity, impulse, and momentum.
- Exercise language, social studies, and math skills in the context of science.
- Use scientific thinking processes to conduct investigations and build explanations: observing, communicating, comparing, organizing, relating, and inferring.

Scientific and Engineering Practices(SP/EP)

●Asking questions (SP)/ Defining problems(EP)
●Developing and using models
●Planning and carrying out investigations
●Analyzing and Interpreting data Constructing explanations(SP)
●Using mathematics and comp. thinking
●Constructing explanations (SP)/Designing solutions (EP)
●Engaging in argument from evidence
●Obtaining, evaluating, and communicating information

Overview of FORCE AND MOTION FOSS Module			
Instructional Objectives	**Subject Matter Content**	**NGSS Standards**	**Activities**
Investigation 1: HERE TO THERE Students are introduced to motion as a change of position, and distance as the magnitude of a change in position. •Observe and describe an object's motion in terms of change of position. • Explain how to use a reference point to determine the distance moved by an object.	• Position is the location of an object at any given time. • Motion is the act of changing position. • Distance is the amount of change of position. • A reference point is an arbitrary point on an object, used to establish its position. • Calculate distance (*d*) using the distance equation.	**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	•They work with air trolleys to define terms, gather and graph data, and analyze outcomes. They analyze graphic representations of races between several different competitors in both print and multimedia formats. •Students will be able to view and

• Measure distance in standard metric units. • Use tools to gather data and mathematics to organize data.		relative positions. **(MS-PS3-2)** •The motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero, its motion will change. The greater the mass of the object, the greater the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion. **(MS-PS2-2)** •All positions of objects and the directions of forces and motions must be described in an arbitrarily chosen reference frame and arbitrarily chosen units of size. In order to share information with other people, these choices must also be shared. **(MSPS2-2)** **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	respond to FOSS Multimedia: *Moving Along*

		systems. (MS-PS2-1),(MS-PS2-4), **Scientific and Engineering Practices (SP/EP)** ●Asking questions (SP)/ Defining Problems (EP) ●Developing and using models ●Planning and carrying out investigations ●Analyzing and Interpreting data Constructing explanations(SP) ●Obtaining, evaluating, and communicating information	
Investigation 2: Speeds Students learn that speed is the rate at which an object changes position. • Conduct experiments to acquire distance and time data and to determine speed. • Use tools to gather data and mathematics to organize data. • Use mathematics to solve problems involving unknown quantities. • Explain speed in terms of distance and time.	• Speed is the rate of change of position of an object: $v = d / \Delta t$. • The slope of the line on a speed graph represents speed; steeper slopes represent higher speeds. • The equation for calculating distance when speed and time are known is $d = v \times \Delta t$. • Average speed is the total distance traveled by an object divided by the total time needed to go that distance.	•**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. •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	•They gather data from cars rolling down ramps and representations of moving vehicles to investigate and solve speed problems. They are introduced to making and analyzing distance-versus time graphs. •Students will be able to read and respond to FOSS ARTICLES • *Time: The Infinite Line (optional)* • *First in Flight* • *How Fast Do Things Go?*

		given object, a larger force causes a larger change in motion. **(MS-PS2-2)** **Scientific and Engineering Practices (SP/EP)** ●Asking questions (SP)/ Defining problems (EP) ●Developing and using models ●Planning and carrying out investigations ●Analyzing and Interpreting data Constructing explanations(SP) ●Using mathematics and comp. thinking ●Constructing explanations(SP) /Designing solutions (EP) ●Engaging in argument from evidence ●Obtaining, evaluating, and communicating information	
Investigation 3: Comparing Speeds Students learn how to analyze and represent speed to solve problems. • Conduct experiments to acquire time and distance data and to determine speed. • Use tools to gather and organize data and solve problems	• The slope of a line on a distance versus-time graph represents speed; steeper slopes represent higher speeds. • A distance-versus-time graph can be used to determine an object's speed.	•**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. •Conduct an investigation and	•They gather data for students walking and running, and use representations of boat races and the Iditarod race to investigate and solve speed problems. They practice making and analyzing speed graphs.

involving unknown quantities. • Use speed graphs to determine head starts. • Explain speed in terms of distance and time.		evaluate the experimental design to produce data to serve as the basis for evidence that can meet the goals of the investigation. **(MS-PS2-5** **Scientific and Engineering Practices (SP/EP)** ●Asking questions (SP)/ Defining Problems (EP) ●Planning and carrying out investigations ●Analyzing and Interpreting data Constructing explanations(SP) ●Using mathematics and comp. thinking ●Constructing explanations(SP) /Designing solutions (EP) ●Obtaining, evaluating, and communicating information	• Students will be able to view and respond to FOSS Multimedia: *Photo Finish,* FOSS Multimedia: *Graphing and* Video: *Sled Dogs: An Alaskan Epic.* •Students will read and respond to FOSS ARTICLE *Iditarod: The Last Great Race on Earth*
Investigation 4: Representing Motion Students learn to represent motion in graphs. They distinguish between position graphs and distance graphs and analyze both to describe motion. •Use tools to gather and organize data. • Transform narrative accounts of motion events into graphic representations. • Generate motion	• The difference between an object's initial and final positions is displacement. • Constant speed and average speed yield straight lines on distance-versus time graphs. • Complex motion events can be analyzed into coherent segments called legs.	**PS3.B: Conservation of Energy and Energy Transfer** When the motion energy of an object changes, there is inevitably some other change in energy at the same time. **(MS-PS3-5)** •The motion of an object is determined by the sum of the forces acting on it;	• They extract data from word problems, create data tables, and construct motion graphs. They also collect and organize data for their own motion, using meter tapes and stopwatches. • Students will read and respond to FOSS ARTICLES • *Motion Review*

scenarios from graphic representations of motion events. • Explain the difference between displacement and distance. • Explain what a horizontal line on a speed graph represents.		if the total force on the object is not zero, its motion will change. The greater the mass of the object, the greater the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion. **(MS-PS2-2)** **Scientific and Engineering Practices (SP/EP)** ●Asking questions (SP)/ Defining Problems (EP) ●Analyzing and Interpreting data Constructing explanations(SP) ●Using mathematics and comp. thinking	• *Boston Treasure Hunt* • *Riding on Springer Hill*
Investigation 5: Acceleration Students learn to identify and measure changing velocity and calculate position and velocity from time and acceleration data. • Use tools (mechanical and electronic Dotcars) to collect time and distance data and mathematics to organize and analyze the data. • Use equations to calculate acceleration, displacement, and velocity of rolling objects. • Identify and interpret	• Acceleration is change of velocity (🎮v–) per unit time, measured in units of change of position (🎮*x*) per unit of time per unit of time. • Objects rolling down slopes accelerate; acceleration is greater on steeper slopes. • The mass of a rolling car has little effect on its acceleration.	•**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. **PS3.B: Conservation of Energy and Energy Transfer** When the motion energy of an object changes, there is inevitably some other change in	• They experience constant velocity and acceleration with their own movement. They collect and analyze velocity and position data using mechanical and electronic Dotcars. • Students will be able to view and respond to: FOSS Multimedia: *Dotmaker* FOSS Multimedia: *Dotcar* software

graphs of accelerating motion and constant velocity.		energy at the same time. **(MS-PS3-5)** •Conduct an investigation and evaluate the experimental design to produce data to serve as the basis for evidence that can meet the goals of the investigation. **(MS-PS2-5)** **Scientific and Engineering Practices (SP/EP)** ●Asking questions (SP)/ Defining problems(EP) ●Developing and using models ●Planning and carrying out investigations ●Analyzing and Interpreting data Constructing explanations(SP) ●Using mathematics and comp. thinking ●Constructing explanations (SP)/Designing solutions (EP)	Video: *Galileo: On the Shoulders of Giants* Students read and respond to FOSS Articles: • *Faster and Faster* • *The Other Great Race: Armadillo and Hare* • *The Making of a Dotcar*
Investigation 6: FORCE Students are introduced to forces and their relationship to motion. • Use tools (pushers, spring scales, and multimedia simulations) to apply force and investigate friction and motion.	• A force is a push or pull. • Net force is the sum of all the forces acting on a mass. • A net force applied to a mass produces acceleration. • Friction is a force that acts to resist movement.	•Conduct an investigation and evaluate the experimental design to produce data to serve as the basis for evidence that can meet the goals of the investigation**.** **(MS-PS2-5)**	•Students use pushers and spring scales to explore the idea that forces add; the sum is net force. Friction is introduced as a force opposing motion. Students explore friction with real-world and

• Analyze illustrations of forces in motion. • Use multimedia simulations to investigate force and motion. • Describe change of motion as a result of net force.		•**MS-PS2-2.** Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object. **Scientific and Engineering Practices (SP/EP)** ●Asking questions (SP)/ Defining problems(EP) ●Developing and using models ●Analyzing and Interpreting data Constructing explanations(SP) ●Using mathematics and comp.thinking ●Obtaining, evaluating, and communicating information	simulated force-bench activities. •Students will read and respond to FOSS ARTICLES • *Aristotle, Galileo, & Newton* • *The Force Bench Free Experimentation*
Investigation 7: Gravity Students learn that gravity is a universal force pulling objects to Earth with predictable acceleration. • Determine the relationship between mass and the force of gravity, using spring scales. • Gather time and displacement data electronically to investigate the acceleration of gravity. • Explain gravity as a universal force. • Discuss Galileo's discovery of acceleration due to gravity.	• Gravity is a force pulling masses toward each other; the strength of the force depends on the objects' masses. • The force of gravity accelerates objects in free fall and objects rolling downhill. • The acceleration produced by the force of gravity is about 10 m/s2 toward Earth.	●Gravitational forces are always attractive. There is a gravitational force between any two masses, but it is very small except when one or both of the objects have large mass—e.g., Earth and the sun. **(MS-PS2-4)** **MS-PS2-4.** Construct and present arguments using evidence to support the claim that gravitational interactions are	They use spring scales to establish the relationship between force and mass. They explore real and hypothetical falling objects and replicate one of Galileo's experiments. Students will read and respond to FOSS ARTICLES • *Gravity: It's the Law* • *How to Get and Hold on to a Moon* •Students will be

		attractive and depend on the masses of interacting objects. **Scientific and Engineering Practices (SP/EP)** ●Asking questions (SP)/ Defining problems (EP) ●Developing and using models ●Planning and carrying out investigations ●Analyzing and Interpreting data Constructing explanations(SP) ●Obtaining, evaluating, and communicating information	able to view and respond to video *Galileo: On the Shoulders of Giants*
Investigation 8: Momentum Students learn to analyze collision interactions in terms of inertia, momentum, and impulse. • Conduct simple investigations to demonstrate inertia of both stationary and moving masses. • Use a force scale to determine the force needed to stop cars traveling at different speeds. • Use electronic Dotcar data to calculate velocity and momentum. • Explain how inertia and momentum affect passenger safety in car crashes. • Explain and apply the	• Inertia is the property of matter that tends to keep masses in uniform motion; it resists change of motion. • Inertia is proportional to mass; large masses have a lot of inertia. • Momentum is inertia in motion; it is the product of an object's velocity and mass. • A net force applied to an object can change its momentum. • An impulse is a force applied for a period of time.	•Conduct an investigation and evaluate the experimental design to produce data to serve as the basis for evidence that can meet the goals of the investigation. **(MS-PS2-5)** •Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy and matter flows within systems**.** **(MS-PS2-1),(MS-PS2-4)** •When two objects	•Students use the Dotcar to collect data for analysis. *Understanding Car Crashes.* The finale is a version of the egg drop called Bean Brains, in which students apply their knowledge of momentum. •Students will be able to view and respond to crash video.

interplay of force and time (impulse) and momentum in crashes.		interact, each one exerts a force on the other that can cause energy to be transferred to or from the object. **(MS-PS3-2)** **MS-PS2** Motion and Stability: Forces and Interactions Students who demonstrate understanding can: Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects. (**MS-PS2-1)** **Scientific and Engineering Practices (SP/EP)** ●Asking questions (SP)/ Defining problems(EP) ●Developing and using models ●Planning and carrying out investigations ●Analyzing and Interpreting data Constructing explanations(SP) ●Obtaining, evaluating, and communicating information	

6th GRADE SCIENCE **Newton's Toy Box**

STUDENTS WILL BE ABLE TO:
• Observe that an object at rest remains at rest until a force acts on it
• Describe the motion of an object when it experiences a force
• Describe the relationship between mass and weight
• Observe the relationship between force and acceleration
• Observe the relationship between force and mass
• Predict the falling rate of balls of different masses
• Observe the trajectory of a thrown ball
• Apply what they observe to the game of basketball
• Predict how the ball would behave in a microgravity environment
• Measure the distance traveled and the elapsed time for a moving object
• Calculate the speed of a moving object
• Observe how the speed of a moving object changes on different surfaces
• Observe the acceleration of a car rolling down a ramp
• Calculate the average speed of the car at two different points on the ramp
• Determine whether the car is accelerating
• Identify the action and reaction forces when a ball bounces
• Predict the behavior of a spring jumper on the basis of action-reaction forces

Scientific and Engineering Practices(SP/EP)
●Asking questions (SP)/ Defining problems(EP)
●Developing and using models
●Planning and carrying out investigations
●Analyzing and Interpreting data Constructing explanations(SP)
●Using mathematics and comp. thinking
●Constructing explanations (SP)/Designing solutions (EP)
●Engaging in argument from evidence
●Obtaining, evaluating, and communicating information

Overview of Newton's Toy Box, Delta Science Module			
Instructional Objectives	**Subject Matter Content**	**NGSS Standards**	**Activities**
ACTIVITIES 1, 2, and 3 Students review gravity, motion, and the relationship between mass and force. They observe simple behaviors and then define them using the terms *motion, force, mass, velocity, inertia, gravity*, and *acceleration*. • Observe that an object at rest remains at rest until a force acts on it • Describe the motion of	•**Newton's First Law of Motion:** An object will remain in motion or at rest unless acted upon by an external force. •**Newton's second law of motion:** An object acted on by a net force will accelerate in the direction of the force. •The object's acceleration equals the net force on the	•**MS-PS2-4.** Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects. •Forces that act at a distance (electric, magnetic, and gravitational) can be	•**Activity 1, Motion in Review:** Students will be able to demonstrate Newton's First Law of Motion with a wooden ball on a smooth, flat, level table. Then push the ball and describe the direction of the force. •**Activity 2, Gravity and Balance:** Students will measure the strength of the forces acting on the ball by using a spring scale.

an object when it experiences a force • Describe the relationship between mass and weight • Observe the relationship between force and acceleration • Observe the relationship between force and mass • Predict the falling rate of balls of different masses	object divided by the object's mass. •**Law of universal gravitation:** force of attraction that exists between any two objects with mass •**Velocity** is the rate at which an object moves in a certain Direction. •**Acceleration** is the rate at which an object's velocity changes •**Inertia** is the tendency of a still or moving object to resist a change in its motion. •A **force is a** push or pull that acts on an object, causing it to move, change speed or direction, or stop moving.	explained by fields that extend through space and can be mapped by their effect on a test object (a charged object, or a ball, respectively). **(MS-PS2-5)** **Scientific and Engineering Practices (SP/EP)** ●Asking questions (SP)/ Defining Problems (EP) ●Developing and using models ●Planning and carrying out investigations ●Analyzing and Interpreting data Constructing explanations(SP) ●Using Mathematics and comp. thinking ●Constructing explanations (SP)/Designing solutions(EP)	They will convert weight in pounds to Newton's. •**Activity 3, Moving Masses:** Students will demonstrate Newton's Second Law of Motion by dropping a wooden ball and a steel ball from the same height at the same time.
ACTIVITY 4: The Parachute Drop Students continue to explore the laws of motion. They investigate the variables that affect air resistance when they construct a parachute and use it to slow the speed of falling objects. • observe the effects of air resistance on falling objects • use air resistance to slow the speed of a falling object • compare the parachute	•The upward force of the air as it opposes the motion of a falling object is called air resistance. •**Air resistance is** fluid friction acting on an object moving through air; also called drag.	•**MS-PS2-4.** Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects. **MS-PS3-1.** Construct and interpret graphical displays of data to describe the relationships of	**ACTIVITY 4, The Parachute Drop:** Students will be able to drop a flat paper and a crumbled paper at the same time and determine which paper experiences a greater air resistance force. •Students will use a kite string and plastic sheeting to make a parachute that will slow down the speed of a falling wooden ball. Students will create a replica of their

requirements for objects of different masses		kinetic energy to the mass of an object and to the speed of an object. **Scientific and Engineering Practices (SP/EP)** ●Asking questions (SP)/ Defining problems(EP) ●Developing and using models ●Planning and carrying out investigations ●Analyzing and Interpreting data Constructing explanations (SP) ●Using mathematics and comp. thinking ●Constructing explanations (SP)/Designing solutions(EP) evidence ●Obtaining, evaluating, and communicating information	parachute and drop a tennis ball from it at the same time as the wooden ball.
ACTIVITY 5, Basketball Arc Students examine the parabolic path of a tossed ball. While playing the familiar game of basketball, students recognize just how they manipulate the angle of the arc in order to correctly position where the ball will fall. • observe the trajectory of a thrown ball • apply what they observe	T • The path followed by a projectile flying or an object moving under the action of given forces is called trajectory.	•Forces that act at a distance (electric, magnetic, and gravitational) can be explained by fields that extend through space and can be mapped by their effect on a test object (a charged object, or a ball, respectively). **(MS-PS2-5)**	**ACTIVITY 5, Basketball Arc:** •Students will be able to try to hit a target dot on a wall using a ball. They will describe and draw the path of the ball. •Students will try to toss a basketball directly into a hoop then try to bank it in by using the backboard. •Students will predict if an astronaut in space

to the game of basketball • predict how the ball would behave in a microgravity environment		**Scientific and Engineering Practices (SP/EP)** ●Asking questions (SP)/ Defining problems(EP) ●Obtaining, evaluating, and communicating information	could make both shots. Students will confirm the answer by watching a video of astronaut Greg Harbaugh playing basketball in space.
Activity 6, **Ball and Cup Contest:** Students experiment with the traditional "ball and cup" and then explain how gravity and Newton's second law affect the toy. • observe the path of a circling ball • describe how gravity is used to catch the ball • predict how the toy can be operated in a microgravity environment	•**Newton's second law of motion:** An object acted on by a net force will accelerate in the direction of the force.	•**MS-PS2-4.** Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects. •Forces that act at a distance (electric, magnetic, and gravitational) can be explained by fields that extend through space and can be mapped by their effect on a test object (a charged object, or a ball, respectively). **(MS-PS2-5)** **Scientific and Engineering Practices (SP/EP)** ●Asking questions (SP)/ Defining problems(EP) ●Developing and using models ●Planning and carrying out investigations ●Analyzing and Interpreting data Constructing Explanations (SP)	Activity 6, **Ball and Cup Contest:** •Students will be able to construct a ball and cup toy. They will swing the toy and try to get the ball in the cup and record how many tries were required. •Students will be able to predict if astronaut John Casper can get the ball in the cup using the same toy while orbiting Earth in a shuttle. They will view the video to confirm an answer.

		●Obtaining, evaluating, and communicating information	
ACTIVITIES 7, 8, and 9: Experimenting with toy cars **ACTIVITY 7** Students calculate the speed of a toy car in three different situations and then identify the degree of friction as the variable that accounts for the differences in speed. **ACTIVITY 8** Students accelerate their toy cars by elevating the track to form a ramp. Students vary the elevation of the ramp and then measure the resultant speeds of the descending cars using stopwatches. **ACTIVITY 9** Students measure the actual acceleration of their cars as they descend the ramp. • measure the distance traveled and the elapsed time for a moving object • calculate the speed of a moving object • observe how the speed of a moving object changes on different surfaces • calculate the average speed of a car rolling down a ramp • compare the speed of a car to its starting height on the ramp • relate gravitational potential energy to kinetic energy • observe the acceleration of a car rolling down a ramp	•The force that opposes the forward motion of a moving object is friction. •**Newton's First Law of Motion:** An object will remain in motion or at rest unless acted upon by an external force. •**Acceleration** is the rate at which an object's velocity changes •**Kinetic energy is** energy an object has due to its motion •**Potential energy** is energy that is stored, available as a result of an object's position or condition •**Inclined plane** is simple machine that is a slope, a surface with one end raised higher than the other end; also called a ramp •Forces act on objects to cause or to stop motion**.** All around us, objects of different sizes are moving in different ways, for different reasons, at different speeds, and in different directions.	**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)** • **MS-PS2-4.** Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects. • 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-PS3-1.)** • 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-PS3-2.)**	• **Activity 7, Rolling On:** Students test their toy cars on a track with wheels, sliding on top and rolling on a towel. They calculate the distance traveled, speed and time. • **ACTIVITY 8, Great Race:** Students create a ramp for their toy car that is 20cm and 30cm They calculate the average speed and determine which cars had the greatest potential energy and greatest kinetic energy. • Activity 9, **Accelerating Masses:** Students will create a ramp that is 35cm and determine how the car's speed changes as it rolls down the longest ramp.

• calculate the average speed of the car at two different points on the ramp • determine whether the car is accelerating		**Scientific and Engineering Practices (SP/EP)** ●Asking questions (SP)/ Defining problems(EP) ●Developing and using models ●Planning and carrying out investigations ●Analyzing and Interpreting data Constructing explanations(SP) ●Using mathematics and comp. thinking ●Constructing explanations (SP)/Designing solutions(EP) ●Engaging in argument from evidence ●Obtaining, evaluating, and communicating information	
ACTIVITY 10, The Come Back Can: Students explore Newton's third law of motion—action and reaction—with a come-back can, a simple device that stores and then releases energy. Students construct the cans, observe their behavior, and then describe it in terms of potential and kinetic energy. • construct a come-back can	**Newton's third law of motion:** For every action force exerted on an object, the object will exert an equal and opposite reaction force. •**Kinetic energy is** energy an object has due to its motion.	**MS-PS2 Motion and Stability: Forces and Interactions** Students who demonstrate understanding can: •**MS-PS2-1.** Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects. •**Energy and Matter**	**ACTIVITY 10, The Come Back Can:** Students will create a Come Back Can and describe how gravity affects the can as well as locate where kinetic energy is the most. They will predict if how the can would work in space then view a video of astronaut using the instrument in space.

• predict what will happen to the can when it is rolled forward • demonstrate how energy is conserved in a come-back can		Energy may take different forms (e.g. energy in fields, thermal energy, energy of motion). **(MS-PS3-5)** **Scientific and Engineering Practices (SP/EP)** ●Asking questions (SP)/ Defining problems(EP) ●Obtaining, evaluating, and communicating information	
ACTIVITIES 11 and 12 The Grasshopper Game Students continue to examine action and reaction by way of spring jumpers and student-assembled paper models of grasshoppers. • identify the action and reaction forces when a ball bounces • predict the behavior of a spring jumper on the basis of action-reaction forces • describe the action and reaction forces involved in a flipping paper grasshopper • compare the jumping ability of paper grasshoppers of different masses	**Newton's second law of motion:** An object acted on by a net force will accelerate in the direction of the force. •The object's acceleration equals the net force on the object divided by the object's mass.	**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)** **Scientific and Engineering Practices (SP/EP)** ●Asking questions (SP)/ Defining problems (EP) ●Developing and using models ●Planning and carrying out investigations ●Analyzing and Interpreting data Constructing explanations(SP) ●Constructing	•**Activity 11 Action-Reaction:** Students will experiment with a jumper. They will record the height of the jumper, height of the jumper with two pennies and the height the jumper reaches with no top. •**Activity 12, The Grasshopper Game:** Students will create a large paper grasshopper and a small paper Grasshopper. They will compare the jumping ability and determine the action force and reaction force.

		explanations (SP)/Designing solutions (EP) ●Obtaining, evaluating, and communicating information	
ACTIVITY 13, Clacker Conservation: Students demonstrate conservation of momentum, another way of looking at Newton's third law, using free hanging objects. They experiment with another popular toy, the clacker, and describe its behavior in terms of momentum and transfer of energy. • observe and identify action and reaction forces that cause the clacker to behave as it does • identify momentum conservation behaviors in clackers that demonstrate that momentum is conserved • predict which clacker behaviors will be possible in microgravity	**Newton's third law of motion** for every action force exerted on an object, the object will exert an equal and opposite reaction force. •**Momentum** is the property of matter due to its mass and Velocity. •The total momentum of two or more interacting objects does not change unless an outside force acts on it.	• **MS-PS2 Motion and Stability: Forces and Interactions** Students who demonstrate understanding can: • **MS-PS2-1.** Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects. • Conduct an investigation and evaluate the experimental design to produce data to serve as the basis for evidence that can meet the goals of the investigation. **(MS-PS2-5** **Scientific and Engineering Practices (SP/EP)** ●Asking questions (SP)/ Defining problems(EP) ●Developing and using models ●Analyzing and Interpreting data Constructing explanations(SP) ●Obtaining,	**ACTIVITY 13, Clacker Conservation:** Students experiment with clacker and try to keep the swinging motion going with the balls circling the handle. Students will view astronaut using clacker in space.

		evaluating, and communicating information	
Simple and Compound Machines: Students list and read about compound and simple machines. They apply the following terms to their experiments; compound machine, efficiency, fulcrum, gear, inclined plane, input force, lever, machine, mechanical advantage, output force, pulley, screw, simple machine, wedge, wheel and axle, work input, work and output.	•**A machine is a** device that changes a force to make work easier •**Mechanical advantage is the** ratio of the input force to the output force for a given machine •**A simple machine is a** tool with few or no moving parts that changes the direction or size of a force in order to do work •**A compound machine is a** combination of two or more simple machines that work together •**A wedge is a** simple machine with one or two sloping sides that meet at a sharp edge or point •**A wheel and axle is a** simple machine made up of a wheel fixed to a smaller shaft; both rotate together •**A pulley is a** simple machine made up of a wheel with a groove in the rim for a rope or cable •**A screw is a** simple machine that is an inclined plane wrapped around a	•Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy and matter flows within systems**.** **(MS-PS2-1),(MS-PS2-4)** **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)** **Scientific and Engineering Practices (SP/EP)** ●Asking questions (SP)/ Defining problems (EP) ●Obtaining, evaluating, and communicating information	•Students view and simple machines and compound machines. They identify these in real life. •Students utilize http://www.edheads.org/ to view machines working. •Students read and reflect on the other following articles: **Machines and Work** • Mechanical Advantage • Efficiency • Simple Machines• Compound Machines

	cylinder •**A second-class lever is a** lever with the output force located between the input force and fulcrum •An **output force is a** force produced by a machine		

6th GRADE SCIENCE **Planetary Science**

- The Moon can be observed both day and night.
- At all times, half of Earth is illuminated (day) and half is dark (night).
- Daytime and nighttime are the result of Earth's rotation on its axis.
- The tilt of Earth's axis and Earth's revolution around the Sun results in seasons.
- Scale is the size relationship between a representation of an object and the object.
- The Moon shines as a result of reflected light from the Sun. Half of the Moon is always illuminated (except during a lunar eclipse).
- Craters can be categorized by size and physical characteristics: simple, complex, terraced, ringed (or basin), and flooded.
- The solar system formed during a sequence of events that started with a nebula.
- The Moon formed after a massive collision between the forming Earth and a planetesimal about the size of Mars.
- The distance between solar system objects is enormous.
- Liquid water is essential for life as we know it.
- Scientific missions provide data about the composition and environmental conditions on the planets, moons, and other bodies in the solar system.

- Planetary-system objects move in measurable and predictable patterns.
- The magnitude and duration of the dip in light intensity during a transit reveals information about the planet.

Scientific and Engineering Practices(SP/EP)

●Asking questions (SP)/ Defining problems(EP)
●Developing and using models
●Planning and carrying out investigations
●Analyzing and Interpreting data Constructing explanations(SP)
●Using mathematics and comp. thinking
●Constructing explanations (SP)/Designing solutions (EP)
●Engaging in argument from evidence
●Obtaining, evaluating, and communicating information

Overview of Planetary Science FOSS Module			
Instructional Objectives	**Subject Matter Content**	**NGSS Standards**	**Activities**
Investigation 1: Where Am I? School to Space The Ideas of frame of reference and point of view are incorporated into their description of where they are. **Where Am I? Moon Watch** Students go outdoors, turn their gazes away from Earth, and discover the Moon. After observing the shape, tilt, color, size, and location of the Moon, students share what they know about how the Moon changes over time. To check their ideas, students start a Moon log to chart daily changes.	● Location or position can be described in terms of a frame of reference (relationship to other objects). ●Point of view is the position from which a visual observation is made. ●Altitude is the distance above Earth's surface. ●Elevation is the distance above average sea level. ●The Moon can be observed both day and night.	●Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. **(MS--ESS1--3),(MS--ESS1-4)** ●**MS--ESS1--1.** Develop and use a model of the Earth-Sun-Moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons. ●Patterns can be used to identify cause--and- effect relationships. **(MS--ESS1--1)** ●Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through	●Students use web--based images centered on their school to observe and describe where they are as their point of view moves away from Earth's surface in powers of ten. When students Retreat to a distance of 10,000 km above their school, they can see that they are on Earth, a planet surrounded by the darkness of space. ●Observe the schoolyard and draw a map to represent the area. ●Interpret representations of human-made and natural structures in aerial photographs. ●Relate information from different frames of reference. ●Students observe the shape, tilt size of the Moon during different phases and log what they see.

		measurement and observation. **(MS--ESS1--1), (MS--ESS1--2)** ●Graphs and charts can be used to identify patterns in data. **(MS--PS4--1)** **Scientific and Engineering Practices (SP/EP)** ●Constructing explanations(SP) ●Asking questions (SP)/ Defining problems(EP) ●Analyzing and Interpreting data Constructing explanations (SP) ●Designing solutions(EP) Obtaining, evaluating, and communicating information	
Investigation 2: A Round Spinning Earth: Sailing Ships Students are asked to generate evidence that Earth is a sphere. They sail a small ship across models of flat and spherical Earths. They work with a multimedia simulation of ships sailing across a flat sea and a curved sea. Students develop a rational argument for a spherical Earth. **Earth/Sun Relationship**	● Line of sight is the straight, unimpeded path taken by light from an object to an eye. ● Objects appear to sink when they move across the ocean and slip below the horizon on a curved surface. ●At all times, half of Earth is illuminated (day), and half is dark (night). ●Daytime and nighttime are the result of Earth's rotation on its axis. ●Earth's axis tilts at an angle of 23.5° and	●**MS--ESS1--1**. Develop and use a model of the Earth--sun--moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons. ●Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models.	● Students sail a small ship across models of flat and spherical Earths. They work with a multimedia simulation of ships sailing across a flat sea and a curved sea. Students develop a rational argument for a spherical Earth. ● Make shadow observations , collect and organize information, graph shadow data, and describe and

After writing an explanation for what causes day and night, students imagine one of their eyes as an observer on Earth and position themselves around a lamp to observe night and day. Students discover that rotation of Earth results in day and night and, in the process, figure out which direction Earth rotates on its axis. Students also learn about the tilt of Earth's axis and Earth's yearly rotation around the Sun.	points toward the North Star.	**(MS-ESS1--1**) ●Patterns can be used to identify cause--and--effect relationships. **(MS--ESS1--1)** ●Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. **(MS--ESS1-3),(MS --ESS1--4)** ●Models can be used to represent systems and their interactions. **(MS-- ESS1--2)** **Scientific and Engineering Practices (SP/EP)** ●Developing and using models ●Asking questions (SP)/ Defining problems(EP) ●Planning and carrying out Investigations ●Analyzing and Interpreting data ●Constructing explanations (SP)/Designing solutions(EP) ●Engaging In argument From evidence ●Obtaining, evaluating, and communicating information.	explain the resulting relationship. ●Students use globes and a light bulb to learn about the Earth's axis and day and night.
Investigation 3: Seasons, Summer Heat	● The lower the angle at which light strikes a	**●MS--ESS1--1**. Develop and use a	● Students use a flashlight to observe

Students investigate the variables that describe seasons using light. Beam spreading is introduced as The mechanism that affects the energy density of light falling on Earth's surface. Students find that beam spreading and duration of sunshine are the main variables that affect the temperature during the seasons. **Seasons, Day Length** Students read an account of day length around the planet and graph the duration of daylight throughout the year. They determine that tilt of Earth on its axis, and the invariable angle of the tilt, can account for variable day length. They determine that the tilt and direction of Earth's axis and Earth's position in its orbit around the Sun account for seasons.	surface, the lower the density of the light energy. ●Beam spreading affects the intensity of solar radiation on Earth's surface. ●The tilt of Earth's axis and Earth's revolution around the Sun results in seasons. ●The duration of daylight at a position on Earth's surface varies as Earth revolves around the Sun, due to the tilt of Earth's axis.	model of the Earth--sun--moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons. ●Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models. **(MS--ESS1--1**) **Scientific and Engineering Practices (SP/EP)** ●Developing and using models ●Asking questions (SP)/ Defining problems(EP) ●Planning and carrying out Investigations ●Analyzing and Interpreting data ●Constructing explanations (SP)/Designing solutions(EP) ●Engaging In argument From evidence ●Obtaining, evaluating, and communicating information.	that a flashlight beam shining directly perpendicular to the floor produces a round spot, and the same beam directed at an angle produces an elongated, oval spot. The area covered by the same beam of light changes, depending on the angle. ●Students use a globe and light bulb to discover the reason for the seasons.
Investigation 4: Moon Study **A Close Look at the Moon** Students focus on the Moon's surface features.	●The Moon has surface features that can be identified in telescope images: craters, Maria, and mountains.	●**MS--ESS1--3.** Analyze and interpret data to determine scale properties of objects in the solar system.	●They study images of the Moon to observe and catalog the major features. Students also read a myth that originated

Students then generate a set of questions about the Moon, organize them into categories, and use them to guide their continued inquiry into the Moon. **How Big/How Far?** Students explore the Earth/Moon relationship by creating a scaled model of the system.	●The Moon, Earth's satellite, is slightly more than one--fourth Earth's diameter and orbits at a distance of about 384,000 kilometers. ●Scale is the size relationship between a representation of an object and the object. ●Scale can be expressed as a ratio when an object and its representation are measured in related units.	**Scientific and Engineering Practices (SP/EP)** ●Developing and using models ●Asking questions (SP)/ Defining problems(EP)	in Maori culture to explain the appearance of the Moon. ●Students create an original Moon Myth to explain the appearance of the Moon or the Moon's Origin. ●Using a small globe as a starting point, they calculate the diameter of a ball to represent the companion Moon, and then position it at the right distance to represent the Moon's orbital distance.
Investigation 5 Observed Patterns: Students update and study their Moon Logs to determine the sequence of changes. They learn phase vocabulary, then study moonrise. **Moon-Phase Models** Students complete a Moon--phase sheet that displays images of phases from two points of view simultaneously. Moon- Phase Simulation **Moon--‑Phase Simulation** Students work with multimedia simulations—"Phases of the Moon" and "Lunar Calendar"—to reinforce their understanding of what	● The Moon goes through phases: "new" to "full" and back to "new" in a 4--week cycle. ● The Moon shines as a result of reflected light from the Sun. Half of the Moon is always illuminated (except during a lunar eclipse). ● The Moon revolves around Earth once in 4 weeks, resulting in the Moon's rising about 50 minutes later each day. ●The revolution of the Moon around Earth and the rotation of Earth on its axis account for the phases of the Moon and the time of day (or night)when the Moon is visible.	● **MS--ESS1--1.** Develop and use a model of the Earth--sun--moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons. ● Patterns can be used to identify cause--and--effect relationships. **(MS--ESS1--1)** ●Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. **(MS--ESS1--1),**	● Students use small polystyrene balls and a light source to simulate Moon phases. They incorporate their small globes into the system to obtain another point of view on Moon phase mechanics. ● They use a light source and a large Moon globe to study Sun/Earth/Moon relationships, including eclipses. ● To help them visualize the points of view, students assemble an Earth--Moon model, using their globes

causes the phases of the Moon.		**(MS--ESS1--2) MS--ESS1-3),(MS--ESS1--4)** **Scientific and Engineering Practices (SP/EP)** ●Asking questions (SP)/ Defining problems (EP) ●Developing and using models ●Planning and carrying out investigations ●Analyzing and Interpreting data Constructing explanations(SP) ●Constructing explanations (SP)/Designing solutions(EP) ●Engaging in argument from evidence ●Obtaining, evaluating, and communicating information	and polystyrene balls, and work with a Moon-phase puzzle.
Investigation 6: Moon Craters Students are introduced to the historical controversy regarding the origin of the craters on the Moon: impacts or volcanism? **Moon Craters, Target Earth** Students scrutinize the Moon's Maria to determine the frequency of major impacts since mare formation 4 billion years ago.	●Craters of various sizes and types result when meteoroids of various sizes impact the surface of planets and satellites. ●Craters can be categorized by size and physical characteristics: simple, complex, terraced, ringed(or basin), and flooded.	● **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. ● The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are	●Students design experiments using flour and marbles or rocks to investigate different variables and determine if impact events could be responsible for the extensive cratering on the Moon's surface. ●Students use photos of the Moon and Maria as well as data to determine the number of major Earth impacts over the same

		held in orbit around the sun by its gravitational pull on them**.(MS--ESS1-2),(MS--ESS1--3)** ● 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 can be used to identify cause--and--effect relationships. **(MS--ESS1--1)** ● Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. **(MS--ESS1-3),(MS--ESS1--4)** **Scientific and Engineering Practices (SP/EP)** ●Asking questions (SP)/ Defining problems(EP) ●Developing and using models ●Planning and carrying out investigations ●Analyzing and Interpreting data Constructing	period and to determine the frequency of such events on Earth.

		explanations(SP) ●Using mathematics and comp. thinking ●Constructing explanations (SP)/Designing solutions(EP) ●Engaging in argument from evidence ●Obtaining, evaluating, and communicating information	
Investigation 7: Beyond the Moon **What's Out There?** Students generate drawings depicting all the objects in the solar system. Students use images and information to organize the cards, including putting them in order based on distance from Earth. To do so, students learn to think of celestial distance in astronomical units and light--years. **Origins** Students study and sequence ten Solar System Origin cards, starting with a nebula. As a result of reasoning and class discussion, students determine the cards' most likely sequence, which should vary only slightly from nebula, contracting, heating, disk forms, Sun turns on, condensing, accreting, gas giants, rocky planets, and flinging. Students are presented	● The solar system includes the Sun; eight planets and their satellites; and a host of smaller objects, including dwarf planets, asteroids, comets, Kuiper Belt objects, and Oort Cloud matter. ●The solar system formed during a sequence of events that started with a nebula of dust and gas. ●The Moon formed after a massive collision between the forming Earth and a planetesimal about the size of Mars.	● **MS--ESS1--3.** Analyze and interpret data to determine scale properties of objects in the solar system. ● Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe. **(MS--ESS1--2)** ● The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them.**(MS--ESS1--2),(MS--ESS1--3**) ●Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. **(MS--ESS1--3),(MS--ESS1-4)**	●Students draw what they believe to be in the solar system. ●They then work in pairs with a set of cosmos cards that represent objects in the universe. ●They analyze cosmos objects that fall into three categories: solar system, Milky Way galaxy, and universe. ●Students see video animations of the four theories, students choose and defend one of the theories.

with four theories to explain the formation of our Moon: capture, daughter, big impact, and sisters.		● **MS--ESS1--1.** Develop and use a model of the Earth--sun--moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons. ● **MS--ESS2--2.** Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. **Scientific and Engineering Practices (SP/EP)** ●Asking questions (SP)/ Defining Problems (EP) ●Developing and using models ●Planning and carrying out investigations ●Obtaining, evaluating, and communicating information	
Investigation 8: The Solar System **Where Are the Planets?** Students attempt to understand the relative sizes and spacing of the planets and the Sun by making a proportional companion of their 12 cm Earth Globe.	●The distance between solar system objects is enormous. ●Liquid water is essential for life as we know it. ● The temperature on a planet depends on two Major variables: distance from the Sun and the nature of the	● **MS--‐ESS1--‐3.** Analyze and interpret data to determine scale properties of objects in the solar system. ● Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in	●First students determine how big to make the Sun and how far away to place it to be a proportional companion for their 12 cm Earth globe. Next they make a model of the inner solar system, scaled 1 cm = 1 million

Comparing Temperatures and Atmospheres Students predict the temperature range and average temperature for Each of the eight planets. **Where Is the Water?** Students study satellite images of typical water -related landforms on Earth.	planet's mediating atmosphere. ● Images can convey information about the presence and history of liquid water on planetary surfaces.	the universe. **(MS--‑ESS1--‑2)** ● The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them. **(MS--‑ESS1--‑2),(MS--‑ESS1--‑3)** ● Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. **(MS--‑ESS1-‑3),(MS--‑ESS1--‑4)** ● Models can be used to represent systems and their interactions. **(MS--‑ESS1--‑2)** ● Patterns can be used to identify cause--- and---effect relationships. **(MS--‑ESS1--‑1)** ● Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. **(MS--‑ESS1--‑1),**	km. Finally they imagine a 1m Sun in their classroom, and place the planets on a map of their community. ●Students use actual atmospheric data and temperature data to look for a relationship between atmosphere and temperature. Finally, students think about the interactions of several planetary environmental factors that make it possible for the liquid water to be present, a key factor in the search for life. ●Students identify bodies of Liquid water(ocean, lake, river) and deposits of ice and snow, as well as landforms that suggest the presence of water at earlier times. They search images of planets and satellites for evidence of water on extraterrestrial bodies in the solar system.

		● Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. **MS--ESS2-2.** ● Water's movements—both on the land and underground-cause weathering and erosion, which change the land's surface features and create underground formations. **(MS--‑ESS2-‑2)** **Scientific and Engineering Practices (SP/EP)** ●Developing and using models ●Planning and carrying out investigations ●Obtaining, evaluating, and communicating information	
Investigation 9: Space Explorations, Light Spectra Students learn that most of the information used by Astronomers comes to them as light. Students learn that light travels in waves of many different wavelengths, and the wavelength determines its color. **Exploration of the Solar System** Students review what	●A spectroscope analyzes the wavelengths of light(spectrum)coming from a light source. ●Scientists use spectral data from distant moons, planets, and stars to determine their temperature, composition, motion, and more ●Scientific missions provide data about the	● **MS--‑PS4--‑1.** Use mathematical representations to describe a simple model for waves that include show the amplitude of a wave is related to the energy in a wave. ● A simple wave has a repeating pattern with a specific wavelength, frequency, and	●Students use a Spectroscope to observe the radiant spectra of a number of light sources, including the Sun, fluorescent lamps, and incandescent lamps. They learn that bright emission lines and dark absorption lines in a spectrum provide information about the composition of

they've been learning about big questions in astronomy, as well as past, current and future NASA Missions.	composition and environmental conditions on the planets, moons, and other bodies in the solar system.	amplitude. **(MS--‐PS4--‐1)** ● 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)** ● Technologies extend the measurement, exploration, modeling, and computational capacity of scientific investigations. (**MS--‐PS4--‐3)** ● Advances in technology influence the progress of science and science has influenced advances in technology. **(MS--‐PS4--‐3)** ● Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation.(**MS--‐ESS1--‐1), (MS--‐ESS1--‐2)** ● Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe. **(MS--‐ESS1--‐2)** ● The solar system consists of the sun	the light source ●Having researched past, present, and future NASA missions, students reflect on what answers the missions found and what methods are planned for answering the questions that frame current and future missions.

		and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them.**(MS--‑ESS1--‑2),(MS--‑ESS1--‑3)** ● 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--‑ESS 1--‑3)** **Scientific and Engineering Practices (SP/EP)** ●Asking questions (SP)/ Defining Problems (EP) ●Developing and using models ●Planning and carrying out investigations ●Analyzing and Interpreting data Constructing explanations(SP) ●Obtaining, evaluating, and communicating information	
Investigation 10: Orbits and New Worlds **The Moons of Jupiter:** Students study images of Jupiter to discover that it has four bright	●Planetary---system objects move in measurable and predictable patterns. ●A transit occurs when a planet passes	Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described,	●Just as Galileo did more than 400 years ago, students track the motion of the moons to determine their orbit radii and

moons. **Looking for Planets**: Students investigate techniques that scientists use to find and study planets orbiting other stars. **Investigation 11: What Is Our Cosmic Address?** Students review what they have learned in the course and restate their cosmic address.	between a star and an observer, causing a dip in the intensity of light from the star. ● The magnitude and duration of the dip in light intensity during a transit reveals information about the planet. ●Location can be described in relation to a frame of reference	predicted, and explained with models**.** **(MS-‑ESS1-‑1)** The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them.(**MS-‑ESS1-‑2),(MS-‑ESS1-‑3)** Patterns can be used to identify cause-‑and-‑effect relationships.(**MS-‑ESS1-‑1)** Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. **(MS-‑ESS1-‑3),(MS-‑ESS1-‑4)** 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-‑ESS1-‑3)** Science assumes that objects and events in natural systems occur in consistent patterns that are understandable	periods, using records of observed data collected over 19 consecutive nights. ●Using an orrery and light sensor, Students generate transit graphs and analyze them to draw conclusions about unknown planets. They are introduced to the NASA Kepler Mission and its goal to find Earth-‑size planets in our galaxy.

		through measurement and observation.**(MS---ESS1---1),(MS---ESS1---2)** Graphs and charts can be used to identify patterns in data.**(MS---PS4---1)** Advances in technology influence the progress of science and science has influenced advances in technology. **(MS---PS4---3)** This model of the solar system can explain eclipses of the sun and the moon. Earth's spin axis is fixed in direction over the short--- term but tilted relative to its orbit around the sun. The seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year.(**MS---ESS1---1)** **Scientific and Engineering Practices (SP/EP)** ●Asking questions (SP)/ Defining Problems (EP) ●Developing and using models ●Analyzing and Interpreting data Constructing explanations(SP)	

		●Obtaining, evaluating, and communicating information	

*The Star Lab will come to WTB during this unit of instruction to review constellations, moon phases, stars, and other material covered in this unit.

Curriculum written by Sarah Ann Franke June 2015

Bloomingdale School District

Bloomingdale, NJ

Adopted: September

Science

Grade 7

2015

Grade 7 Science is aligned to the NJSLS-S which are correlated to the NJSLS-ELA and NJSLS-M. There is a focus on learning science through investigation and through reading non-fiction texts and inquiry-based science exploration.

Science Department

Grade 7: Weather and Water / FOSS MS / NJSLS-S

Inv	**Inv Title**	**Part**	**Part Summary**	**Sessions**	**Content**	**NJSLS-S / NGSS Performance Expectations Addressed**	**Disciplinary Core Ideas Framework**	**Crosscutting Concepts**
1	What is Weather?	1	**Into the Weather** Students delve into the question, What is weather? They view video segments of severe weather, and generate inquiry questions stimulated by the video and discussions. Meteorology is introduced as the science of weather.	3	• Weather is the condition of Earth's atmosphere at a given time in a given place. • Severe weather has the potential to cause death and destruction in the environment. • Meteorology is the science of weather, and meteorologists are the people who study Earth's weather.	Foundational for 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. Foundational for 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.	ESS2.C: The Roles of Water in Earth's Surface Processes • The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. (MS-ESS2-5) 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)	Stability and Change • Stability might be disturbed either by sudden events or gradual changes that accumulate over time.
1	What is Weather?	2	**Local Weather Students view local weather reports and determine the factors that combine to produce what we know as weather. They are introduced to a digital weather center to measure temperature, air pressure, and humidity. They use the tools to acquire daily data for their local site, and use media tools to track weather in another city.**	2	• Weather and climate are different.	Foundational for 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. Foundational for MS-ESS2-5. Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.	ESS2.C: The Roles of Water in Earth's Surface Processes • The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. (MS-ESS2-5) ESS2.D: Weather and Climate • Because these patterns are so complex, weather can only be predicted probabilistically. (MS-ESS2-5)	Cause and Effect • Cause and effect relationships may be used to predict phenomena in natural or designed systems
2	Where's the Air?	1	**The Air Around** Us Students work with syringes and tubing to discover that air takes up space and is compressible. They tackle the question, Does air have mass? Using available classroom materials, they design a procedure that will demonstrate that air has mass.	2	• Air is matter; it occupies space, has mass, and can be compressed.	Foundational for MS-ESS2-5. Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions. Foundational for 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.	PS1.A: Structure and Properties of Matter • Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. (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)	Cause and Effect • Cause and effect relationships may be used to predict phenomena in natural or designed systems. Systems and System Models • Defining the system under study-specifying its boundaries and making explicit a model of that system - provides tools for understanding and testing ideas that are applicable throughout science and engineering.
2	Where's the Air?	2	**Earth's Atmosphere** Students study Earth's atmosphere using diagrams, photos from space, and a reading. They are introduced to the atmosphere as a mixture of gases with properties that change with altitude above Earth's surface.	3	• The atmosphere is the layers of gases surrounding Earth. • Weather happens in the troposphere, the layer of the atmosphere closest to Earth's surface. • The troposphere is a mixture of nitrogen (78%), oxygen (21%), and other gases (1%), including argon, carbon dioxide, and water vapor.	Foundational for MS-ESS2-5. Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.	PS1.A: Structure and Properties of Matter • In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change relative locations. (MS-PS1-4)	Patterns • Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them.
3	Air Pressure and Wind	1	**Air-Pressure Inquiry** Students assemble pressure indicators (clear tubes in bottles filled with green water). They investigate the effect of air pressure on the system and consider how density is affected by air pressure. They view a demonstration of how changing air pressure affects a **barometer.**	2	• Pressure exerted on a gas reduces its volume and increases its density.	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. Foundational for MS-ESS2-5. Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.	PS1.A: Structure and Properties of Matter • In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change relative locations. (MS-PS1-4) • Gases and liquids are made of molecules or inert atoms that are moving about relative to each other.	Cause and Effect • Cause and effect relationships may be used to predict phenomena in natural or designed systems.

							(MS-PS1-4)	
3	Air Pressure and Wind	2	**Pressure Maps** Students are introduced to pressure maps and isobars as a means for representing air pressure over a large region. They locate high- and low pressure areas on maps and predict where winds will blow and in what direction. What students predict does not exactly match what occurs because of other factors, which are introduced in a later investigation to clear up the mystery.	2	• Wind is a large-scale movement of air. • Air tends to move from regions of high pressure to regions of low pressure. • Air pressure is represented on a map by contour lines called isobars.	MS-ESS2-5. Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.	ESS2.C: The Roles of Water in Earth's Surface Processes • The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. (MS-ESS2-5) ESS2.D: Weather and Climate • Because these patterns are so complex, weather can only be predicted probabilistically. (MS-ESS2-5)	Cause and Effect • Cause and effect relationships may be used to predict phenomena in natural or designed systems.
4	Convection	1	**Density of Fluids** Students investigate density of fluids by layering colored salt solutions in a straw. They determine the relative densities of the salt solutions by comparing the masses of equal volumes. They calculate the density of each solution, using the ratio of mass to volume.	3	• Density is the ratio of a mass to its volume. • If two fluids have equal volumes but differ in mass, the one with the greater mass is more dense.	Foundational for 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.	PS1.A: Structure and Properties of Matter • Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. (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) ESS2.C: The Roles of Water in Earth's Surface Processes • Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents. (MS-ESS2-6)	Cause and Effect • Cause and effect relationships may be used to predict phenomena in natural or designed systems. 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. Systems and System Models • Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy, matter, and information flows within systems
4	Convection	2	**Convection in Water** Students are introduced to convection in liquids as a mechanism for energy transfer. They observe the interaction of colored water of different temperatures to determine that warm water rises and cold water descends	2	• As matter heats up, it expands, causing the matter to become less dense. • Convection is the circulation of fluid (liquid or gas) that results from energy transfer; relatively warm masses rise and relatively cool masses sink.	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. Foundational for 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. MS-PS3-4. Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.	PS1.A: Structure and Properties of Matter • In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change relative locations. (MS-PS1-4) • Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. (MS-PS1-4) ESS2.C: The Roles of Water in Earth's Surface Processes • Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents. (MS-ESS2-6) PS3.A: Definitions of Energy • Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present. (MS-PS3-3),(MS-PS3-4) PS3.B: Conservation of Energy and Energy Transfer • The amount of energy transfer needed to change the temperature of a matter sample by a given amount depends on the nature of the matter, the size of the sample, and the environment. (MS-PS3-4) • Energy is spontaneously transferred out of hotter regions or objects and into colder ones. (MS-PS3-3)	Cause and Effect • Cause and effect relationships may be used to predict phenomena in natural or designed systems. 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. • Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. Energy and Matter • The transfer of energy can be tracked as energy flows through a designed or natural system. • Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter.
4	Convection	3	**Convection in Air** Students observe a model convection	3	• Convection is the circulation of fluid (liquid or gas) that	MS-PS1-4. Develop a model that predicts and describes changes in	ESS2.D: Weather and Climate • Weather and climate are influenced by	Cause and Effect • Cause and effect relationships may be used to predict

			chamber to confirm that convection cells operate in air. The observations are extrapolated to the real world, where warm air masses move upward and cool air masses sink.		results from energy transfer; relatively warm masses rise and relatively cool masses sink	particle motion, temperature, and state of a pure substance when thermal energy is added or removed. Foundational for 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.	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) PS3.A: Definitions of Energy • Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present. (MS-PS3-3),(MS-PS3-4) PS3.B: Conservation of Energy and Energy Transfer • Energy is spontaneously transferred out of hotter regions or objects and into colder ones. (MS-PS3-3)	phenomena in natural or designed systems. 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. Systems and System Models • Models can be used to represent systems and their interactions - such as inputs, processes and outputs - and energy, matter, and information flows within systems. Energy and Matter • The transfer of energy can be tracked as energy flows through a designed or natural system. • Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter.
5	Heat Transfer	1	**Latitude** Students examine weather data from two groups of cities to compare cities at different latitudes where other variables have been controlled. They make a greater distinction between weather and climate, then draw conclusions about the effect of latitude on climate	2	Latitude is a factor that affects local weather and climate	Foundational for 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	ESS2.D: Weather and Climate • Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. (MS-ESS2-6)	Cause and Effect • Cause and effect relationships may be used to predict phenomena in natural or designed systems.
5	Heat Transfer	2	**Solar Angle Light is introduced as a form of energy.** Students observe a demonstration of solar angle that uses a flashlight shining on surfaces at various angles and a beam of light shining on a globe. They compare the effect of a beam of light when it falls on surfaces at different angles and determine that the greater the solar angle, the greater the energy transfer	2	• The angle at which light from the Sun strikes the surface of Earth is the solar angle. • The lower the solar angle is, the less intense the light is on Earth's surface. • The Sun is the major source of energy that heats the atmosphere, and solar energy is transferred by radiation.	MS-ESS1-1. Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons. 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.	ESS1.B: Earth and the Solar System • Earth's spin axis is fixed in direction over the short-term but tilted relative to its orbit around the sun. The seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year. (MS-ESS1-1)	Patterns • Patterns can be used to identify cause-and-effect relationships. Systems and System Models • Models can be used to represent systems and their interactions. 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.
5	Heat Transfer	3	**Heating Earth** Students are introduced to energy transfer by radiation. They investigate what happens to different earth materials (sand, soil, water, air) when placed in sunshine and then in shade. They set up an experiment and collect and analyze the data. Students observe the differential heating of earth materials, one factor that contributes to weather	3	• The Sun is the major source of energy that heats the atmosphere, and solar energy is transferred by radiation. • Heat is the increase of kinetic energy of particles.	MS-PS3-4. Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.	PS3.A: Definitions of Energy • Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present. (MS-PS3-3),(MS-PS3-4) PS3.B: Conservation of Energy and Energy Transfer • The amount of energy transfer needed to change the temperature of a matter sample by a given amount depends on the nature of the matter, the size of the sample, and the environment. (MS-PS3-4)	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. Energy and Matter • The transfer of energy can be tracked as energy flows through a designed or natural system
6	Air Flow	1	**Conduction** Students observe two examples of heat transfer by conduction: movement of heat from a container of hot water to a container of cold water, and movement of heat from one end of a metal strip to the other. Students identify conduction as energy transfer between particles as a result of contact	3	• Energy can move from one material to another by conduction.	MS-PS3-4. Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample. MS-PS1-4 Develop a model that predicts and describes changes in particle motrion, temperature, and state of a pure substance when thermal energy is	PS1.A Structure and Properties of Matter • Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. (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) PS3.A:	Cause and Effect • Cause and effect relationships may be used to predict phenomena in natural or designed systems. Energy and Matter • The transfer of energy can be tracked as energy flows through a designed or natural system.

						added or removed.	Definitions of Energy • Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present. (MS-PS3-3),(MS-PS3-4) PS3.B: Conservation of Energy and Energy Transfer • The amount of energy transfer needed to change the temperature of a matter sample by a given amount depends on the nature of the matter, the size of the sample, and the environment. (MS-PS3-4) • Energy is spontaneously transferred out of hotter regions or objects and into colder ones. (MS-PS3-3)	
6	Air Flow	2	**Local Winds** Groups create diagrams that show what happens in the atmosphere to create wind. They label their diagrams to represent differential heating, energy transfer, convection, change of density, change of atmospheric pressure, and wind.	1	• Differential heating of Earth's surface by the Sun can create high- and low pressure areas. • Local winds blow in predictable patterns determined by local differential heating.	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-ESS2-5. Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions. 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.	PS1.A: Structure and Properties of Matter • Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. (MS-PS1-4) ESS2.C: The Roles of Water in Earth's Surface Processes • The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. (MS-ESS2-5) ESS2.D: Weather and Climate • Because these patterns are so complex, weather can only be predicted probabilistically. (MS-ESS2-5) • 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) PS3.A: Definitions of Energy • Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present. (MS-PS3-3),(MS-PS3-4)	Patterns • Patterns can be used to identify cause-and-effect relationships. Cause and Effect • Cause and effect relationships may be used to predict phenomena in natural or designed systems. Systems and System Models • Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy, matter, and information flows within systems. Energy and Matter • Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter.
6	Air Flow	3	**Global Winds** Students revisit their wind predictions from Investigation 3, and start to explore reasons that could explain the unpredicted wind movement. They compare data to their models and determine that convection cells and the Coriolis effect are responsible for the wind patterns on Earth.	3	• Convection cells and Earth's rotation determine prevailing winds on Earth.	MS-ESS2-5. Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions. 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.	ESS2.C: The Roles of Water in Earth's Surface Processes • The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. (MS-ESS2-5) ESS2.D: Weather and Climate • Because these patterns are so complex, weather can only be predicted probabilistically. (MS-ESS2-5) • 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.	Patterns • Patterns can be used to identify cause-and-effect relationships. Cause and Effect • Cause and effect relationships may be used to predict phenomena in natural or designed systems. Systems and System Models • Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy, matter, and information flows within systems. Energy and Matter • The transfer of energy can be tracked as energy flows through a designed or natural system. • Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter.

							(MS-ESS2-6) • 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)	
7	Water in the Air	1	**Is Water Really There?** Students are challenged to come up with investigations to show that water vapor is in the air around them. Materials are provided, and each group plans an investigation, conducts it, and reports to the class in a short presentation	2	• Water changes from gas to liquid by condensation.	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. 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.	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) PS1.A: Structure and Properties of Matter • The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter. (MS-PS1-4)	Patterns • Patterns can be used to identify cause and effect relationships. Cause and Effect • Cause and effect relationships may be used to predict phenomena in natural or designed systems. Systems and System Models • Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy, matter, and information flows within systems.
7	Water in the Air	2	**Phase Change and Energy Transfer** Students experience a temperature change as water evaporates, and ponder the energy transfers involved as water changes from liquid to gas. Humidity is introduced as the measure of water vapor in the air, and students consider dew point	2	• Water changes from liquid to gas (vapor) by evaporation. • Temperature change, which is evidence of energy transfer, accompanies evaporation. • Dew point is the temperature at which air is saturated with water vapor and vapor condenses into liquid.	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. 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.	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) PS1.A: Structure and Properties of Matter • Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. (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) • The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter. (MS-PS1-4) PS3.A: Definitions of Energy • Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present. (secondary to MS-PS1-4) PS3.B: Conservation of Energy and Energy Transfer • The amount of energy transfer needed to change the temperature of a matter sample by a given amount depends on the nature of the matter, the size of the sample, and the environment. (MS-PS3-4)	Patterns • Patterns can be used to identify cause-and-effect relationships. Energy and Matter • Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter
7	Water in the Air	3	**Clouds and Precipitation** Students investigate the relationship between pressure and temperature, using 2 L plastic bottles and thermometer strips. They discover that the greater the pressure in a gas, the higher the temperature. They apply this idea to air rising in the	4	• Water changes from gas to liquid by condensation. • Dew point is the temperature at which air is saturated with water vapor and vapor condenses into liquid. • Increasing the pressure of a given volume of air increases the temperature of air.	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. 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.	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) PS1.A: Structure and Properties of Matter • Gases and liquids are made of molecules or inert atoms that are moving about	Patterns • Patterns can be used to identify cause-and-effect relationships. 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. Cause and Effect • Cause and effect relationships may be used to predict phenomena in

			atmosphere. Air pressure drops as elevation increases, so a mass of air would expand as it ascends. As it expands, it cools. They use this understanding of pressure and temperature to explore cloud formation**.**				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) • The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter. (MS-PS1-4) PS3.A: Definitions of Energy • Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present. (secondary to MS-PS1-4)	natural or designed systems. Energy and Matter • The transfer of energy can be tracked as energy flows through a designed or natural system. • Within a natural or designed system, the transfer o
8	Meteorology	1	**Weather Balloons** Students use an online simulation to analyze data collected by weather balloons launched in Phoenix, AZ, and Chicago, IL. They analyze charts of data collected by weather balloons launched in four cities.	1	• Weather balloons travel high in the atmosphere and collect physical data using a radiosonde. • Data from weather balloon radiosondes can be used to determine dew point and the likelihood of clouds forming.	MS-ESS2-5. Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.	ESS2.C: The Roles of Water in Earth's Surface Processes • The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. (MS-ESS2-5) ESS2.D: Weather and Climate • Because these patterns are so complex, weather can only be predicted probabilistically. (MS-ESS2-5) • 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)	Patterns • Graphs, charts, and images can be used to identify patterns in data. Cause and Effect • Cause and effect relationships may be used to predict phenomena in natural or designed systems. Systems and System Models • Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy, matter, and information flows within systems.
8	Meteorology	2	**Weather Maps** Students consider all the factors that cause weather, and apply their knowledge to interpret a weather map. After learning about fronts, they pull together data about temperature, precipitation, surface wind, air pressure, and fronts to give a weather report for a given location.	4	• Weather maps combine many kinds of atmospheric and surface data, including pressure, temperature, wind direction, wind speed, and precipitation. • Fronts are areas where large air masses collide	MS-ESS2-5. Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions. 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. 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	ESS2.C: The Roles of Water in Earth's Surface Processes • The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. (MS-ESS2-5) • Global movements of water and its changes in form are propelled by sunlight and gravity. (MS-ESS2-4) ESS2.D: Weather and Climate • Because these patterns are so complex, weather can only be predicted probabilistically. (MS-ESS2-5) • 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) • The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents. (MS-ESS2-6) ESS3.B: Natural Hazards Mapping the history of natural hazards in a	Patterns • Graphs, charts, and images can be used to identify patterns in data. Cause and Effect • Cause and effect relationships may be used to predict phenomena in natural or designed systems. Systems and System Models • Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy, matter, and information flows within systems. Energy and Matter • Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter.

							region, combined with an understanding of related geologic forces can help forecast the locations and likelihoods of future events. (MS-ESS3-2)	
9	The Water Planet	1	**Water-Cycle Simulation** Students consider why Earth is called the water planet. They observe a demonstration that shows how Earth's water is distributed. They participate in a simulation of the travels of a water particle through the water cycle. They compare the results of the simulation to their understanding of how the water cycle operates on Earth. After exploring an online version of the simulation, students use what they learned to diagram the water cycle and consider the implications of human water use and human population growth.	2	• Most of Earth's water is saltwater in the ocean, and Earth's fresh water is found in many locations. • A water particle might follow many different paths as it travels through the water cycle.	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 MS-ESS3-4. Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.	ESS2.C: The Roles of Water in Earth's Surface Processes • Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land. (MS-ESS2-4) • Global movements of water and its changes in form are propelled by sunlight and gravity. (MS-ESS2-4) ESS3.A: Natural Resources • Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes. (MS-ESS3-1) ESS3.C: Human Impacts on Earth's Systems. • Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise. (MSESS3-3),(MS-ESS3-4)	Patterns • Patterns can be used to identify cause and effect relationships. • Graphs, charts, and images can be used to identify patterns in data. Cause and Effect • Cause and effect relationships may be used to predict phenomena in natural or designed systems. • Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. Energy and Matter • Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter. Stability and Change • Stability might be disturbed either by sudden events or gradual changes that accumulate over time.
9	The Water Planet	2	**Ocean Currents** Students predict patterns of ocean currents, based on their experience with global winds, then explore actual patterns and causes of ocean currents	1	• Ocean currents are caused primarily by winds, convection of ocean water, and the Coriolis effect.	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. 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.	ESS2.C The Roles of Water in Earth's Surface Processes • The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. (MS-ESS2-5) • Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents. (MS-ESS2-6) ESS2.D: Weather and Climate. • 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) • 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)	Patterns • Patterns can be used to identify cause and effect relationships. • Graphs, charts, and images can be used to identify patterns in data. Cause and Effect • Cause and effect relationships may be used to predict phenomena in natural or designed systems. • Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. Systems and system models Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy, matter, and information flows within systems. Energy and Matter • Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter. Stability and Change • Stability might be disturbed either by sudden events or gradual changes that accumulate over time.
9	The Water Planet	3	**Ocean Climate** Students review climate data for pairs of cities and determine what effect distance from the ocean has on temperature range and average annual rainfall. They consider what properties of the ocean would cause these climate effects	3	• A location's proximity to a large body of water generally results in less temperature variation and more precipitation.	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 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	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) • The complex patterns of the changes and the movement of water in the atmosphere, determined by	Patterns • Patterns can be used to identify cause and effect relationships. • Graphs, charts, and images can be used to identify patterns in data. Cause and Effect • Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. Energy and Matter • Within a natural or

						climates.	winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. (MS-ESS2-5) ESS2.D: Weather and Climate • The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents. (MS-ESS2-6) • 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)	designed system, the transfer of energy drives the motion and/or cycling of matter. Stability and Change • Stability might be disturbed either by sudden events or gradual changes that accumulate over time.
10	Climate Over Time	1	**Climate Change** Students analyze climate graphs for four different geographical locations and look for changes over a 50-year period. They consider evidence of climate changes over geological time periods.	1	• Weather is the condition of the atmosphere at a specific time and location; climate is the average weather in a region over a long period of time. • Climate can change over time because of natural Earth cycles or human-induced changes.	MS-ESS3-5. Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.	ESS2.D: Weather and Climate • Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. (MS-ESS2-6) ESS3.D: Global Climate Change • Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth's mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities. (MS-ESS3-5)	Patterns • Graphs, charts, and images can be used to identify patterns in data. Cause and Effect • Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation. • Cause and effect relationships may be used to predict phenomena in natural or designed systems. • Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. Stability and Change • Stability might be disturbed either by sudden events or gradual changes that accumulate over time. • Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales, including the atomic scale.
10	Climate over Time	2	**The Role of Carbon Dioxide** Using a computer simulation, students explore the effects of carbon dioxide and other greenhouse gases in the atmosphere. They use data to build a case that an increase in greenhouse gases in Earth's atmosphere can lead to an increase in Earth's average temperature (global warming).	2	• When greenhouse-gas concentrations in the atmosphere increase, the global temperature rises. • Human activity can affect Earth's weather and climate.	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. MS-ESS3-5. Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.	ESS2.D: Weather and Climate • Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. (MS-ESS2-6) • Because these patterns are so complex, weather can only be predicted probabilistically. (MS-ESS2-5) ESS3.C: Human Impacts on Earth Systems • Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the technologies involved are engineered otherwise. (MS-ESS3-3), (MS-ESS3-4) ESS3.D: Global Climate Change • Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth's mean surface temperature (global warming). Reducing the level	Patterns • Graphs, charts, and images can be used to identify patterns in data. Cause and Effect • Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation. • Cause and effect relationships may be used to predict phenomena in natural or designed systems. • Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. Systems and System Models • Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy, matter, and information flows within systems. Stability and Change • Stability might be disturbed either by sudden events or gradual changes that accumulate over time.

							of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities. (MS-ESS3-5)	
10	Climate over Time	3	**Climate in the News** Students read summaries of news stories from the past decade, looking for evidence of climate change and whether that change is caused by humans.	1	• Human activity can affect Earth's weather and climate.	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. MS-ESS3-5. Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.	ESS3.A: Natural Resources • Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes. (MS-ESS3-1) ESS3.C: Human Impacts on Earth Systems • Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. (MS-ESS3-3) • Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the technologies involved are engineered otherwise. (MS-ESS3-3), (MS-ESS3-4) ESS3.D: Global Climate Change • Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth's mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities. (MS-ESS3-5)	Patterns • Graphs, charts, and images can be used to identify patterns in data. • Patterns in rates of change and other numerical relationships can provide information about natural and human designed systems. • Patterns can be used to identify cause and effect relationships. Cause and Effect • Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation. • Cause and effect relationships may be used to predict phenomena in natural or designed systems. • Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. Scale, Proportion, and Quanity • The observed function of natural and designed systems may change with scale. Stability and Change • Stability might be disturbed either by sudden events or gradual changes that accumulate over time. • Small changes in one part of a system might cause
10	Climate over Time	4	**Identify Key Ideas** Students look back on the entire Weather and Water Course to review the Weather and Water big ideas they've recorded along the way, and in particular to review the distinction between weather and climate	2	• Weather is the condition of the atmosphere at a specific time and location; climate is the average weather in a region over a long period of time. • Climate can change over time because of natural Earth cycles or human-induced changes.	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-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. MS-ESS2-5. Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions. MS-ESS2-6. Develop and use a model to describe how unequal heating and rotation of the Earth cause	PS1.A: Structure and Properties of Matter • In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change relative locations. (MS-PS1-4) 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) • The complex patterns of the changes and the movement of water in the	Cause and Effect • Cause and effect relationships may be used to predict phenomena in natural or designed systems. Systems and System Models • Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy, matter, and information flows within systems. Stability and Change • Stability might be disturbed either by sudden events or gradual changes that accumulate over time.

						patterns of atmospheric and oceanic circulation that determine regional climates. MS-ESS3-5. Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.	atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. (MS-ESS2-5) ESS2.D: Weather and Climate • Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. (MS-ESS2-6) • The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents. (MS-ESS2-6) ESS3.C: Human Impacts on Earth Systems • Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise. (MSESS3-3),(MS-ESS3-4)	

Grade 7: Earth History /FOSS MS/ NJSLS-S

Inv	**Inv Title**	**Part**	**Part Summary**	**Sessions**	**Content**	**NJSLS-S/ NGSS Performance Expectations Addressed**	**Disciplinary Core Ideas Framework**	**Crosscutting Concepts**
1	Earth is Rock	1	**What's the Story of this Place**? Students consider the history of Earth and begin to think about rock and landforms as a source of evidence for Earth's past. An Earth tour provides a sense of the variety of landforms on the planet.	3	-Earth's surface has a variety of different landforms and water features. -Every place on Earth's surface has a unique geological story. -Rocks hold the clues to the story of a place.			-Graphs, charts, and images can be used to identify patterns in data. -Models are limited in that they only represent certain aspects of the system under study.
1	Earth is Rock	2	**Grand Canyon Rocks** Students learn about the human history of the Grand Canyon, including some of the first scientific expeditions into the canyon. They examine rock samples from two sites in the canyon and learn how to identify limestone, sandstone, and shale.	3	-Every place on Earth's surface has a unique geological story. -Rocks hold the clues to the story of a place. -Limestone, sandstone, and shale are rocks found in the Grand Canyon that can be identified by their characteristics.		ESS1.C: 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	Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. Graphs, charts, and images can be used to identify patterns in data.
1	Earth is Rock	3	**Correlating Grand Canyon Rocks** Students compare the rocks at two sites in the Grand Canyon. They discover that the layers can be correlated between the two sites, indicating that the rock layers extend great distances throughout the Colorado Plateau	2	● Rocks hold the clues to the story of a place. ● Limestone, sandstone, and shale are rocks found in the Grand Canyon that can be identified by their characteristics.	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.	ESS1.C: 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)	Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. Models can be used to represent systems and their interactions.
2	Weathering and Erosion	1	**Sorting Earth Materials** Students sort a rock mixture by hand and model how wind can separate earth materials. Students learn how earth materials can be categorized by size.	1	● Particles of earth material can be categorized and sorted by size: clay, silt, sand, gravel, pebble, cobble, and boulder.	MS-ESS2-1. Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.	ESS2.A: 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. (MSESS2-1)	Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation.
2	Weathering and Erosion	2	**Stream Tables** Students observe erosion and deposition in a stream table and see how earth materials can be sorted by water.	2	● Most landforms are shaped by slow, persistent processes that proceed over the course of millions of years: weathering, erosion, and deposition.	MS-ESS2-2. Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.	ESS2.C: Water's movements—both on the land and underground—cause weathering and erosion, which change the land's surface features and create underground formations. (MS-ESS2-2)	Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. 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. Models can be used to represent systems and their interactions
2	Weathering and Erosion	3	**Weathering** Students create sand and consider how rocks experience abrasion and other forms of physical weathering. Further relationships are drawn between erosional forces	3	● Rock can be weathered into sediments by a number of processes including frost wedging, abrasion, chemical dissolution, and root wedging. ● Most landforms are shaped by	MS-ESS2-2. Construct an explanation based on evidence for how geoscience processes have changed Earth's	ESS2.C: Water's movements—both on the land and underground—cause weathering and erosion, which change the land's surface features and	Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. Explanations of stability and change in natural or designed

			and the sorting that occurs in nature.		slow, persistent processes that proceed over the course of millions of years: weathering, erosion, and deposition.	surface at varying time and spatial scales.	create underground formations. (MS-ESS2-2)	systems can be constructed by examining the changes over time and processes at different scales, including the atomic scale
2	Weathering and Erosion	4	**Soil** Students collect soil from their local environment and perform a simple test to determine which earth materials are found in the soil, answering questions about what happens to sediments that are not turned into sedimentary rocks.	4	● Most sediments move downhill until they are deposited in a basin. Sediments that do not form rock can become widely distributed over Earth's surface as soil.	MS-ESS2-1. Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process	ESS2.A: 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. (MSESS2-1)	Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation.
3	Deposition	1	**Sandstone and Shale** Students consider how sediments accumulate in a basin, in a sorted fashion. They learn that substances in groundwater can form a cement, bonding sand particles together to form sandstone. Students then learn about shale formation.	1	• Sediments deposited by water usually form flat, horizontal layers. • Sediments turn into solid rock (such as sandstone, shale, and limestone) through the process of lithification, which involves compaction, cementation, and dissolution. • Sandstone is a sedimentary rock formed when particles of sand are cemented together. • Shale is a sedimentary rock formed when clay and silt particles are compacted and cemented together.	MS-ESS2-1. Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process. MS-ESS2-2. Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.	ESS2.A: 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. (MSESS-2)	Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. 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. Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation
3	Deposition	2	**Limestone** Students test two oceanic materials to see what might be a component of limestone. They determine that shells contain calcite and are likely to be in limestone.	1	• Sediments turn into solid rock (such as sandstone, shale, and limestone) through the process of lithification, which involves compaction, cementation, and dissolution. • Limestone is a sedimentary rock composed mainly of calcium carbonate, deposited in oceanic basins by physical, chemical, and biological including the atomic scale.	MS-ESS2-1. Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process. MS-ESS2-2. Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.	ESS2.A: 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. (MSESS-2)	Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. 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.
3	Deposition	3	**Interpreting Sedimentary Layers** Students learn about the principle of original horizontality, the principle of superposition, and uniformitarianism. They start to make inferences about past environments, based on evidence found in sedimentary rock layers.	3	• Sediments deposited by water usually form flat, horizontal layers. • The relative ages of sedimentary rock can be determined by the sequence of layers. Lower layers are older than higher layers. • The processes we observe today, such as weathering, erosion, and deposition, probably acted in the same way millions of years ago, producing sedimentary rocks.	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.	ESS1.C: 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)	Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation
4	Fossils and Past Environments	1	**Fossils** Students look for fossils in Grand Canyon rocks, then identify a new set of fossils. Using modern environments for reference, students apply the principle of uniformitarianism to infer the ancient environments that formed Colorado Plateau rock layers.	3	● A fossil is any remains, trace, or imprint of a plant or animal that was preserved in Earth's crust during ancient times. ● The fossil record represents what we know about ancient life and is constantly refined as new fossil evidence is discovered..	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.	ESS1.C: 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) LS4.A: The collection of fossils and their	Patterns in rates of change and other numerical relationships can provide information about natural and human designed systems. Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation.

							placement in chronological order (e.g., through the location of the sedimentary layers in which they are found or through radioactive dating) is known as the fossil record. It documents the existence, diversity, extinction, and change of many life forms throughout the history of life on Earth. (MS-LS4-1)	
4	Fossils and Past Environm ents	2	**A Long Time Ago** A 46-meter (m) time line of Earth's history is rolled out in front of students to help convey the vastness of geological time.	1	● Geological time extends from Earth's origin to the present. ● Earth's history is measured in millions and billions of years	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-ol d history.	ESS1.C: 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) LS4.A: The collection of fossils and their placement in chronological order (e.g., through the location of the sedimentary layers in which they are found or through radioactive dating) is known as the fossil record. It documents the existence, diversity, extinction, and change of many life forms throughout the history of life on Earth. (MS-LS4-1)	Patterns in rates of change and other numerical relationships can provide information about natural and human designed systems. Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.
4	Fossils and Environm ents	3	**Student Time Lines** Students learn about units used to measure geological time and create their own scaled time lines to represent the history of Earth.	2	● Geological time extends from Earth's origin to the present. ● Earth's history is measured in millions and billions of years.	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-ol d history.	ESS1.C: 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)	Patterns in rates of change and other numerical relationships can provide information about natural and human designed systems. Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.
4	Fossils and Environm ents	4	**Index Fossils** Index fossils are introduced as a tool to correlate rock layers, based on age. Students correlate several Colorado Plateau sites, then add the formation of the Grand Canyon rock layers to their time lines	4	● The fossil record represents what we know about ancient life and is constantly refined as new fossil evidence is discovered. ● Index fossils allow rock layers to be correlated by age over vast distances.	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-ol d history MS-LS4-1. Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past. MS-LS4-2. Apply scientific ideas to construct an explanation for	ESS1.C: 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) LS4.A: The collection of fossils and their placement in chronological order (e.g., through the location of the sedimentary layers in which they are found or through radioactive dating) is known as the fossil record. It documents the existence, diversity, extinction, and change of many life forms throughout the history of life on Earth. (MS-LS4-1) LS4.A: Anatomical similarities and differences between various organisms	Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.

						the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.	living today and between them and organisms in the fossil record, enable the reconstruction of evolutionary history and the inference of lines of evolutionary descent. (MSLS4-2)	
5	Igneous Rocks	1	**Earth's Layers** Students study a new set of rocks that are not sedimentary. They identify some characteristics that differentiate these rocks from sedimentary rocks, namely the presence of crystals. Students study the layers of the earth to see what heat source might melt rocks	1	● Earth is composed of layers of earth materials, from its hard crust of rock all the way down to its hot core. ● Heat inside the earth melts rock; melted rock can cool and form igneous rocks.	MS-ESS2-1. Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process. MS-ESS2-2. Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.	ESS2.A: 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. (MSESS-2)	Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.
5	Igneous Rocks	2	**Salol Crystals** Students use salol to model the cooling of igneous rocks and design an experiment to test the effect of cooling rate on crystal formation. They find that slower cooling leads to larger crystal formation and apply that relationship to the environments in which igneous rocks form.	2	● Molten rock cools quickly on the surface of the earth and can be identified by small mineral crystals. Molten rock that cools more slowly inside the Earth forms larger mineral crystals.	MS-ESS2-2. Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales	ESS2.A: 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. (MSESS-2)	Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.
5	Igneous Rocks	3	**Types of Igneous** Rocks Students consider a larger sample set of igneous rocks and determine which rocks are intrusive or extrusive, based on crystal size.	2	● Molten rock cools quickly on the surface of the earth and can be identified by small mineral crystals. Molten rock that cools more slowly inside the Earth forms larger mineral crystals.	MS-ESS2-1. Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process. MS-ESS2-2. Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.	ESS2.A: 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. (MSESS-2)	Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.
6	Volcanoes and Earthquakes	1	**Mapping Volcanoes and Earthquakes** Students map volcanoes. When the class combines the data, specific patterns appear, such as the ring of volcanoes around the Pacific Ocean. Students map earthquakes and discover that the pattern generally matches that of volcanoes. They start to consider why that might be the case**.**	2	● Volcanoes and earthquakes occur along plate boundaries.	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.	ESS3.B: 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 in rates of change and other numerical relationships can provide information about natural and human designed systems. Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. 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
6	Volcanoes and Earthquakes	2	**Moving Continents** Students are introduced to Wegener's theory of continental drift and consider how it might be related to what is causing volcanoes and earthquakes at specific locations on Earth. Students learn about plate boundaries. They explain how plate boundaries might support Wegener's theory and	1	● Earth's crust and solid upper mantle make up Earth's plates. Plates can be the size of continents or larger or smaller. ● Volcanoes and earthquakes occur along plate boundaries	MS-ESS2-3. Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence	ESS2.B: 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)	Patterns in rates of change and other numerical relationships can provide information about natural and human designed systems. Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and processes at different

			explain the existence of volcanoes and earthquakes at specific locations			of the past plate motions.		scales, including the atomic scale.
6	Volcanoes and Earthquakes	3	**Plate Tectonics** Students learn more about the layers of the earth, and convection is introduced. Students explain how plates might induce convection, and they investigate the type of plate boundary interactions that could result. A short video and a reading help students bring all the pieces together to understand the theory of plate tectonics.	3	● Earth's plates "float" on top of the layer of viscous, semisolid earth material below, the asthenosphere. ● The asthenosphere is a heated, semisolid, semifluid material that flows due to convection currents. ● Plate movements result in plate-boundary interactions that produce volcanoes, earthquakes, and continental drift.	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. MS-ESS3-1. Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.	ESS2.B: 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) ESS3.B: 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) ESS3.A: Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes. (MS-ESS3-1)	Patterns in rates of change and other numerical relationships can provide information about natural and human designed systems. 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.
7	Mountains and Metamorphic Rocks	1	**Plate Models** Students use plate models to simulate interactions at plate boundaries that result from plates moving in different ways. They review what they have learned by watching animations of plate movements.	3	● Interactions between tectonic plates at their boundaries deform the plates, producing landforms on Earth's surface. ● Mountains form as a result of plate interactions	MS-ESS2-2. Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. 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.	ESS2.A: 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. (MSESS-2)	Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. 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
7	Mountains and Metamorphic Rocks	2	**Looking at Mountains** Students observe and sort cards that contain information and images of diverse mountain types. They consider the relationship between mountain locations and plate boundaries.	1	● Interactions between tectonic plates at their boundaries deform the plates, producing landforms on Earth's surface. ● Mountains form as a result of plate interactions.	MS-ESS2-2. Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. 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.	ESS2.A: 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. (MSESS-2)	Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. 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.

7	Mountains and Metamorphic Rocks	3	**Metamorphic Rocks** Students observe and describe a number of metamorphic rocks and consider how they might form. Focusing on heat and pressure, students observe a candy model for metamorphic rock formation. They compare rocks to identify the source rocks for specific metamorphic rocks. They organize what they have learned about rocks to develop the rock cycle.	4	● When plates interact, high heat and immense pressure can change rock into new forms of rock (metamorphic rock). ● The rock cycle describes how rock is constantly being recycled and how each type of rock can be transformed into other rock types.	MS-ESS2-1. Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process. MS-ESS2-2. Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.	ESS2.A: 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. (MSESS2-1) ESS2.A: 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. (MSESS-2	Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.
7	Mountains and Metamorphic Rocks	4	**Shenandoah (Optional)** Students explore Shenandoah National Park through a multimedia tour and samples of rocks similar to those at the park. They use this information and a stratigraphic column of the park's rocks to interpret the geological history of the area.	2	● Interactions between tectonic plates at their boundaries deform the plates, producing landforms on Earth's surface. ● Mountains form as a result of plate interactions.	MS-ESS2-2. Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. 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.	ESS2.A: 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. (MSESS-2) ESS2.B: 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)	Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. 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
8	Geoscenarios	1	**Introduction to the Project** Students get a tour of the four geoscenario locations. Each team of students views a multimedia introductory tour specific to their topic and answers questions as a group.	1	● Geological processes help tell the story of a physical place. ● Evidence and observations of a site's geology provide clues to tell the geological story.	MS-ESS3-1. Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes. 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. MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.	ESS3.A: Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes. (MS-ESS3-1) ESS3.B: 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) ESS3.C: Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and	Patterns can be used to identify cause and effect relationships. Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems. Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy, matter, and information flows within systems. Stability might be disturbed either by sudden events or gradual changes that accumulate over time.

							technologies involved are engineered otherwise. (MS-ESS3-3),(MS-ESS 3-4)	
8	Geoscena rios	2	**Team Synthesis** Each student reviews information from a specialist and contributes detailed evidence to the team's presentation. The group develops a time line of events related to their place or process. Students develop their presentation, based on the four guiding questions.	2	● Knowledge of uplift, plate tectonics, volcanism, weathering, erosion, and fossil evidence plus the principles of uniformitarianism, superposition, and original horizontality can help tell the story of a place.	MS-ESS3-1. Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes. 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. MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. MS-ESS3-4. Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems. MS-ESS3-5. Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century. MS-PS1-3. Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.	ESS3.A: Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes. (MS-ESS3-1) ESS3.B: 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) ESS3.C: 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. (MS-ESS3-3),(MS-ESS 3-4) ESS3.D: Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth's mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities. (MS-ESS3-5)	Patterns can be used to identify cause and effect relationships. Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems. Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy, matter, and information flows within systems. Stability might be disturbed either by sudden events or gradual changes that accumulate over time.
8	Geoscena rios	3	**Presentations** Teams split up so that two members explain the presentation to visiting groups, while the other two members visit other presentations, take notes, and ask questions. Then students will switch roles. After they have visited all the presentations, the teams do a selfassessment and a peer assessment.	2	● Geological processes help tell the story of a physical place. ● Knowledge of uplift, plate tectonics, volcanism, weathering, erosion, and fossil evidence plus the principles of uniformitarianism, superposition, and original horizontality can help tell the story of a place.	MS-ESS2-2. Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. MS-ESS3-1. Construct a	ESS2.A: 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. (MSESS-2) ESS3.A:	Patterns can be used to identify cause and effect relationships. Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems.

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9	What is the Story of This Place?	1	**Back to the Grand Canyon** Students use what they have learned about Earth's history and processes to interpret the rock evidence at the Grand Canyon and the geological history of the Grand Canyon.	2	● Evidence that provides clues about Earth's geological history comes from observing rocks, landforms, and other earth materials.	MS-ESS1-4. Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history. MS-ESS2-1. Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process. MS-ESS2-2. Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying	ESS1.C: 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) ESS2.A: 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. (MSESS2-1) ESS2.A: The planet's systems interact over scales	Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.

						time and spatial 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. (MSESS-2)	
9	What is the Story of This Place?	2	**Reviewing the Evidence** Students review evidence from the previous investigations and put together a list of evidence and inferences that help tell Earth's geological story. They review the processes that drive the rock cycle and the constructive and destructive processes that shape Earth. They explore various careers in the geosciences.	2	● Evidence that provides clues about Earth's geological history comes from observing rocks, landforms, and other earth materials. ● Scientists specialize in many different disciplines to collect and analyze evidence to help put together Earth's geological history. ● Scientists use a number of different tools and techniques to analyze and synthesize evidence obtained from Earth to tell its story.	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-ol d history. MS-ESS2-1. Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process. MS-ESS2-2. Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales	ESS1.C: 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) ESS2.A: 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. (MSESS2-1) ESS2.A: 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 shap	Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.

Grade 7: Chemical Interactions / FOSS MS/ NJSLS-S

Inv	**Inv Title**	**Part**	**Part Summary**	**Sessions**	**Content**	**NJSLS-S/ NGSS Performance Expectations Addressed**	**Disciplinary Core Ideas Framework**	**Crosscutting Concepts**
1	Substances	1	**Mystery Mixture** Students begin their study of chemistry by observing a mystery mixture of two white, solid substances (citric acid and sodium bicarbonate). After recording the physical characteristics of the dry mixture, they add water and observe bubbling and fizzing. Students finish Part 1 by recording their observations of the results of adding water to the mixture.	1	-A substance is a form of matter with a unique composition and distinct properties.	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.	PS1.A: Structure and Properties of Matter-Each pure substance has characteristic physical and chemical properties that can be used to identify it. (MS-PS1-2). 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).	Patterns-Microscopic patterns are related to the nature of microscopic and atomic-level structure.
1	Substances	2	**Mixing Substances** Students observe a set of nine white, solid substances, two of which are the substances in the mystery mixture. Using 2-mL wells, mini-spoons, and dropper bottles, they develop a plan for testing pairs of substances to discover which two are in the mystery mixture. The fizzing that results from the mixing of 7 different two-substance combinations is introduced as evidence of a chemical reaction, an interaction in which starting substances are changed into new substances. Close observation of the 7 reactions and the residues in the reaction wells after evaporation provides compelling evidence for positive identification of the mystery mixture.	5	-Chemical names communicate information about the composition of substances. -Chemical formulas communicate the composition of substances. -A chemical reaction occurs when substances interact to form new substances (products).	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.	PS1.A: Structure and Properties of Matter-Each pure substance has characteristic physical and chemical properties that can be used to identify it. (MS-PS1-2). 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).	Patterns- Microscopic patterns are related to the nature of microscopic and atomic-level structure.
2	Elements	1	**Periodic Table** Students learn the definition of element, a basic substance that cannot be reduced to simpler substances in chemical interactions. They become familiar with the names and symbols of the 90 naturally occurring elements by studying the periodic table of the	2	-An element is a basic substance that cannot be broken into simpler substances during chemical interactions. -There are 90 naturally occurring elements on Earth.	MS-PS1-1Develop models to describe the atomic composition of simple molecules and extended structures.	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	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)

			elements. Students review the chemical formulas for the substances used in Investigation 1, catalog the elements, and locate them on the periodic table. They learn how the elements are grouped in the periodic table using the interactive multimedia periodic table and by reading an article about the development of the periodic table.		-Elements combine to make all the substances on Earth. -The periodic table of the elements displays all the naturally occurring and synthesized elements. -The relative abundance of elements varies with location in the universe.		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)	
2	Elements	2	**Elements in the World.** Students study the lists of ingredients in consumer products to discover what elements are present. The class then places self-stick notes on the periodic table poster to indicate those elements found in products. They then determine the total number of elements, the most common elements, and the number of metallic elements in the products. Students read an article about the distribution of elements in the universe, the Earth, and in living organisms.	2	-Elements combine to make all the substance on Earth.	MS-PS1-1Develop models to describe the atomic composition of simple molecules and extended structures.	PS1.A: Structure and Properties of Matter ♣ Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. (MS-PS1-1) ♣ Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). (MS-PS1-1)	Scale, Proportion, and Quantity ♣ Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (MS-PS1-1)
3	Particles	1	**Capture the Gas** After observing the inflation of a balloon placed over a sodium bicarbonate and citric acid reaction, students conduct controlled experiments to determine the volume of gas produced. The experiment includes making a stock solution of acid, measuring solids carefully, and measuring the volume of gas produced during the reaction.	2	-Gas is matter- it has mass and occupies space.	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.	PS1.A: Structure and Properties of Matter-Each pure substance has characteristic physical and chemical properties that can be used to identify it. (MS-PS1-2). 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).	Patterns-Microscopic patterns are related to the nature of microscopic and atomic-level structure.
3	Particles	2	**Air is Matter** Students learn that the gas produced in the reaction is carbon dioxide, one of many gases in air. Students investigate air to confirm that it qualifies as matter-it has mass and occupies space. They use syringes to discover that air can be forced into a smaller space (compressed) or larger space (expanded). Students then develop explanations for their observations, starting to develop a particulate model for matter.	2	-Gas is matter- it has mass and occupies space. -Gas compresses when force is applied; gas expands when force is withdrawn.	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.	PS1.A: Structure and Properties of Matter-Each pure substance has characteristic physical and chemical properties that can be used to identify it. (MS-PS1-2). 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).	Patterns-Microscopic patterns are related to the nature of microscopic and atomic-level structure.
3	Particles	3	**Air as Particles** Students work with syringes and foam cubes to refine their model of air (gas) as independent particles with significantly large distances between them. They use representations to show the changes in particle density during compression and expansion.	1	-During compression and expansion, the number and character of particles in a sample of gas do not change; space between particles does change. -Gases are composed of widely spaced individual particles in constant motion. -There is nothing between gas particles except space.	MS-PS1-1Develop models to describe the atomic composition of simple molecules and extended structures.	PS1.A: Structure and Properties of Matter ♣ Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. (MS-PS1-1)	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)
4	Kinetic Energy	1	**Gas Expansion** After reviewing the properties and composition of gas, students work with "empty" 1/2 –liter plastic water bottles to find out what happens to air when it is heated and cooled. Students observe that	2	-Kinetic energy is energy of motion. -The particles in substances gain kinetic energy as they warm, and lose kinetic energy as they cool.	MS-PS1-4. Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance	PS1.A: Structure and Properties of Matter- ♣ Gases and liquids are made of molecules or inert atoms that are moving about relative to	Cause and Effect ♣ Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS1-4)

			air expands when heated and contracts when cooled. They then use the kinetic particulate model to explain expansion and contraction.		-Matter expands when the kinetic energy of its particles increases; matter contracts when the kinetic energy of its particles decreases.	when thermal energy is added or removed.	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) The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter. (MS-PS1-4) PS3.A: Definitions of Energy ♣ The term "heat" as used in everyday language refers both to thermal energy (the motion of atoms or molecules within a substance) and the transfer of that thermal energy from one object to another. In science, heat is used only for this second meaning; it refers to the energy transferred due to the temperature difference between two objects. (secondary to MSPS1-4) ♣ The temperature of a system is proportional to the average internal kinetic energy and potential energy per atom or molecule (whichever is the appropriate building block for the system's material). The details of that relationship depend on the type of atom or molecule and the interactions among the atoms in the material. Temperature is not a direct measure of a system's total thermal energy. The total thermal energy (sometimes called the total internal energy) of a system depends jointly on the temperature, the total number of atoms in the system, and the state of the material. (secondary to MS-PS1-4)	
4	Kinetic Energy	2	**Liquid Expansion** Students make a water thermometer with a glass bottle, plastic tube, and rubber stopper. They place the water-filled system in cold water, then hot water. They observe the contraction and expansion of liquid water in response to cooling and heating. Students then apply their understanding of kinetic theory to explain liquid expansion, including how a thermometer works.	2	-Matter expands when the kinetic energy of its particles increases; matter contracts when the kinetic energy of its particles decreases.	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.	PS1.A: Structure and Properties of Matter- ♣ Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. (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) The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter.	Cause and Effect ♣ Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS1-4)

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4	Kinetic Energy	3	**Solid Expansion** Students observe the brass sphere-and-ring demonstration. At room temperature, the sphere passes easily through the ring. When the ring is cooled in ice water, and the sphere is heated on a burner, the sphere will not pass easily through the ring. Students observe that solids expand and contract.	1	Matter expands when the kinetic energy of its particles increases; matter contracts when the kinetic energy of its particles decreases.	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.	PS1.A: Structure and Properties of Matter- ♣ Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. (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) The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter. (MS-PS1-4) PS3.A: Definitions of Energy ♣ The term "heat" as used in everyday language refers both to thermal energy (the motion of atoms or molecules within a substance) and the transfer of that thermal energy from one object to another. In science, heat is used only for this second meaning; it refers to the energy transferred due to the temperature difference between two objects. (secondary to MSPS1-4) ♣ The	Cause and Effect ♣ Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS1-4)

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5	Energy Transfer	1	**Mixing Hot and Cold** Students call on their knowledge of mixing hot and cold liquids to predict the final temperature of a mixture of equal masses of hot and cold water. They conduct the activity and then determine an algorithm for calculating final temperatures based on the results of their investigations.	1	-Mixing water of two temperatures results in an intermediate temperature.	MS-PS3-4. Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample	PS3.A:Definitions of Energy Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present. (MS-PS3-4) PS3.B:Conservation of Energy and Energy Transfer The amount of energy transfer needed to change the temperature of a matter sample by a given amount depends on the nature of the matter, the size of the sample, and the environment. (MS-PS3-4)	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-PS3-4)
5	Energy Transfer	2	**Particle Collisions** Students grapple with the concept of energy transfer as a consequence of collisions between particles. They engage in group discussions, listen to mini-lectures, watch interactive multimedia animations, and participate in a structured classroom reading. They are introduced to temperature as the average kinetic energy of particles in a substance, and they study how a thermometer works.	2	-Substances heat or cool as a result of energy transfer. -Energy transfers between particles when they collide. Energy transfer by contact is conduction. -Energy always transfers from high kinetic energy to low kinetic energy. -Equilibrium occurs when temperature is uniform.	MS-PS3-4. Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample	PS3.A:Definitions of Energy Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present. (MS-PS3-4) PS3.B:Conservation of Energy and Energy Transfer The amount of energy transfer needed to change the temperature of a matter sample by a given amount depends on the nature of the matter, the size of the sample, and the environment. (MS-PS3-4)	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-PS3-4)
5	Energy Transfer	3	**Heat** Students are introduced to the calorie as a unit of heat. They conduct a water-mixing investigation and use the results to calculate the number of calories transferred from hot water and to cold water during the interactions. The numbers are equal, supporting the notion of conservation of energy.	3	-Heat is measured in calories. One calorie will raise the temperature of 1 g of water 1 degree C. -Temperature is measured in degrees Celsius. Temperature is the average kinetic energy of particles. -Energy is conserved.	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.	PS1.A: Structure and Properties of Matter- ♣ Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. (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.	Cause and Effect ♣ Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS1-4)

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6	Heat of Fusion	1	**Melting Ice.** Students conduct a mixing experiment involving 60g of hot water and 60 g of a mixture of ice and water at 0 degrees C. They predict the equilibrium temperature and then measure the experimental equilibrium temperature. When the observed temperature is found to be considerably lower than predicted, students develop models to explain the discrepancy. They determine that the missing calories went to melt the ice without raising the temperature. This is introduced as heat of fusion, and students calculate its value in calories per gram. Students then read an expository article about heat of fusion and use data to calculate the heat of fusion of several whimsical substances from other planets.	2	-Heat of fusion is the energy needed to change a solid substance into liquid. -Heat of fusion does not change the kinetic energy of particles in a substance. -The heat of fusion for water is about 80 calories per gram.	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.	PS1.A: Structure and Properties of Matter- ♣ Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. (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) The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter. (MS-PS1-4) PS3.A: Definitions of Energy ♣ The term "heat" as used in everyday language refers both to thermal energy (the motion of	Cause and Effect ♣ Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS1-4)

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7	Phase Change	1	**Dissolve and Melt** Students write a quick write expressing their understanding of the processes of melting and dissolving. They then observe what happens to 4 M&Ms candies in four different environments: hot and dry, cold and dry, in hot water, and in cold water. They then describe the different outcomes for both the colored candy coating and the chocolate center. Students generate definitions for melting and dissolving based on their observations.	1	-Matter exists on Earth in 3 common phases (states)- solid, liquid, and gas. -Melting is change of state caused by heat. -Dissolving is an interaction between two substances in which one substance breaks apart and goes into another substance.	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.	PS1.A: Structure and Properties of Matter- ♣ Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. (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) The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter. (MS-PS1-4) PS3.A: Definitions of Energy ♣ The term "heat" as used in everyday language refers both to thermal energy (the motion of atoms or molecules within a substance) and the transfer of that thermal energy from one object to another. In science, heat is used only for this second meaning; it refers to the energy transferred due to the temperature difference between two objects. (secondary to MSPS1-4) ♣ The temperature of a system is proportional to the average internal kinetic energy and potential energy per atom or molecule (whichever is the appropriate building	Cause and Effect ♣ Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS1-4)

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7	Phase Change	2	**Melting Temperature** Students place 3 materials (margarine, wax, and sugar) in small cups and float them in a container of hot water. As heat transfers to the materials, students observe that the margarine melts, the wax softens, and the sugar remains unchanged. Students observe change of state from solid to liquid and discover that different materials melt at different temperatures. Students work on a mental model to explain what happens at the particle level when a substance changes state from solid to liquid. The model includes kinetic energy, energy transfer, and the relationship of particles with one another.	1	-Melting is a change of state caused by heat. -In solids, particles are held in place and move only by vibrating. -In liquids, particles are held close, but are able to move around and over one another. -Change of state is the result of change of energy in the particles in a sample of matter.	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.	PS1.A: Structure and Properties of Matter- ♣ Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. (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) The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter. (MS-PS1-4) PS3.A: Definitions of Energy ♣ The term "heat" as used in everyday language refers both to thermal energy (the motion of atoms or molecules within a substance) and the transfer of that thermal energy from one object to another. In science, heat is used only for this second meaning; it refers to the energy transferred due to the temperature difference between two objects. (secondary to MSPS1-4) ♣ The temperature of a system is proportional to the average internal kinetic energy and potential energy per atom or molecule (whichever is the appropriate building block for the system's material). The details of that relationship depend on the type of atom or molecule and the interactions among the atoms in the material. Temperature is not a direct measure of a system's total thermal energy. The total thermal energy (sometimes called the total internal energy) of a system depends jointly on the temperature, the total number of atoms in the system, and the state of the material. (secondary to MS-PS1-4)	Cause and Effect ♣ Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS1-4)

7	Phase Change	3	**More Heat** Students use candles to increase the amount of heat transferred to wax and sugar. They observe that both wax and sugar change from solid to liquid when heated with a candle, and change back to solid when the flame is removed. Students use this experience to extend their understanding of melting and to reinforce the idea that different substances melt at different temperatures. Students read an expository article about phase change and the dynamics involved in those changes.	2	-Melting is a change of state caused by heat. -Change of state is the result of change of energy in the particles of matter. -During phase change, particles do not change; relationships between particles do change. -The temperature oat which phase change occur are different for different substances.	MS-PS3-4. Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.	PS3.A: Definitions of Energy Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present. (MS-PS3-4) PS3.B: Conservation of Energy and Energy Transfer The amount of energy transfer needed to change the temperature of a matter sample by a given amount depends on the nature of the matter, the size of the sample, and the environment. (MS-PS3-4)	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-PS3-4)
7	Phase Change	4	**Freeze Water** Students think about freezing water using ice. After observing that an ice environment will not freeze liquid water, they add salt to the ice. Students carefully observe the temperature changes in the vial of ice and in the ice/salt environment. They build an explanation for the cold environment that includes heat of fusion.	2	-Change of state is the result of change of energy in particles. -The processes of phase change are evaporation, condensation, melting, freezing, sublimation, and deposition. -During phase change, particles do not change; relationships between particles do change.	MS-PS3-4. Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.	PS3.A: Definitions of Energy Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present. (MS-PS3-4) PS3.B: Conservation of Energy and Energy Transfer The amount of energy transfer needed to change the temperature of a matter sample by a given amount depends on the nature of the matter, the size of the sample, and the environment. (MS-PS3-4)	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-PS3-4)
7	Phase Change	5	**Gas to Solid** Students investigate all three ordinary states of matter using a condensation apparatus charged with salted ice. Hot water releases water vapor, which condenses as liquid on the icy cup, and then freezes to solid water. The system provides students with an opportunity to observe water quickly progress through the three phases and to experience the conditions that promote those phase changes.	2	-Change of state is the result of change of energy in the particles in a sample of matter. -The process of phase change are evaporation, condensation, melting, freezing, sublimation, and deposition. -During phase change, particles do not change; relationships between particles do change.	MS-PS3-4. Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.	PS3.A: Definitions of Energy Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present. (MS-PS3-4) PS3.B: Conservation of Energy and Energy Transfer The amount of energy transfer needed to change the temperature of a matter sample by a given amount depends on the nature of the matter, the size of the sample, and the environment. (MS-PS3-4)	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-PS3-4)
8	Solutions	1	**Mixtures** Students make two aqueous mixtures, one with soluble sodium chloride, and one with insoluble calcium carbonate. They compare the two mixtures and then attempt to separate them with filters. The salt mixture cannot be separated with the filter. It is identified as a solution and defined. Students then separate the salt solution into its original components using evaporation.	2	-A mixture is a combination of two or more substances. -A solution is a mixture in which one substance dissolves and "disappears" in a second substance. -Dissolving occurs when one substance (solute) is reduced to particles and is distributed uniformly throughout the	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.	PS1.A: Structure and Properties of Matter-Each pure substance has characteristic physical and chemical properties that can be used to identify it. (MS-PS1-2). PS1.B: Chemical Reactions-Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are	Patterns-Microscopic patterns are related to the nature of microscopic and atomic-level structure.

					particles of a second substance (solvent).		regrouped into different molecules, and these new substances have different properties from those of the reactants. (MS-PS1-2).	
8	Solutions	2	**Saturation** Students put 30mL of water in small bottles and add solute, sodium chloride or magnesium sulfate, until no more will dissolve. When no more will dissolve, the solutions are saturated. Students then devise a plan for determining the mass of solute needed to saturate 30mL of water. When the masses have been determined, students compare the amount of solute to conclude that the amount of solute needed to saturate a volume of solvent varies from substance to substance.	2	-A saturated solution has a much solute dissolved in it as possible. -Dissolving involves both kinetic interactions (collisions) and attractive forces (bonds).	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.	PS1.A: Structure and Properties of Matter-Each pure substance has characteristic physical and chemical properties that can be used to identify it. (MS-PS1-2). 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).	Patterns-Microscopic patterns are related to the nature of microscopic and atomic-level structure.
8	Solutions	3	**Concentration** Students are presented with two stock solutions made with magnesium sulfate and water. One solution is made with 20 g of magnesium sulfate in 200mL of water. The other solution is made with 50 g of magnesium sulfate in 200mL of water. The 50 g solution is identified as more concentrated, and concentration is defined. Students then observe that when equal volumes of the two solutions are compared, the more concentrated solution is more massive. Students then make their own magnesium sulfate solutions following assigned recipes. They compare the masses of 20mL samples and use the results to order the class solutions by concentration.	2	-The concentration of a solution is an expression of the ration of solute particles to solvent particles. -Solutions of different concentrations made with the same substances have different densities.	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.	PS1.A: Structure and Properties of Matter-Each pure substance has characteristic physical and chemical properties that can be used to identify it. (MS-PS1-2). 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).	Patterns-Microscopic patterns are related to the nature of microscopic and atomic-level structure.
9	Reaction	1	**Substance Models** Students review chemical formulas as symbolic representations for substances and learn that the fundamental building blocks of substances are atoms. Colored adhesive dots, introduced as representations of atoms, are used to construct two-dimensional representations of compounds-molecules of ionic compounds. Chemical bond is introduced as the attractive force holding particles together. Students make and analyze representations of particles of familiar substances.	1	-Atoms are the fundamental particles of elements. -A compound is a substance composed of two or more different kinds of elements. -Atoms combine to make particles of substances: molecules and ionic compounds. -Molecules and ionic compounds are held together by attractive forces called bonds.	MS-PS1-1. Develop models to describe the atomic composition of simple molecules and extended structures.	PS1.A: Structure and Properties of Matter Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. (MS-PS1-1) Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). (MS-PS1-1)	Scale, Proportion, and Quantity Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (MS-PS1-1)
9	Reaction	2	**Limewater Reaction** Students observe that there is no change when atmospheric air is pumped through a sample of limewater. They then blow exhaled breath through limewater and observe a milky precipitate. Students then use atom tiles to create representations of the reactant molecules and rearrange them to make product molecules. When they ae satisfied that they have re-created the reaction, they write a balanced chemical equation for the reaction, using standard conventions.	2	-A chemical reaction is a process in which the atoms of substances (reactants) rearrange to form new substances (products). -Atoms are neither created nor destroyed during chemical reactions, only rearranged.	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.	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-PS1-5) The total number of each type of atom is conserved, and thus the mass does not change. (MS-PS1-5)	Energy and Matter Matter is conserved because atoms are conserved in physical and chemical processes. (MS-PS1-5)
9	Reaction	3	**Baking Soda and Acid** Students are introduced to hydrochloric acid and think about what might happen if it were mixed with sodium bicarbonate. They observe a demonstration of the reaction and then work with atom	3	-Atoms combine to make particles of substances. -A chemical reaction is a process in which the atoms of substances (reactants) rearrange	MS-PS1-2 Analyze and interpret data on the properties of substances before and after the substances interact to determine	PS1.A: Structure and Properties of Matter-Each pure substance has characteristic physical and chemical properties	Patterns-Microscopic patterns are related to the nature of microscopic and atomic-level structure. (MS-PS1-2).

			tiles to determine the products of the reaction. They then conduct the reaction, bubbling the gas produced through limewater and evaporating the liquid, to confirm that the gas was carbon dioxide and that sodium chloride was dissolved in the liquid.		to form new substances (products). -Atoms are neither created nor destroyed during chemical reactions, only rearranged.	if a chemical reaction has occurred. 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.	that can be used to identify it. (MS-PS1-2). 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). 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-PS1-5) The total number of each type of atom is conserved, and thus the mass does not change. (MS-PS1-5)	Energy and Matter Matter is conserved because atoms are conserved in physical and chemical processes. (MS-PS1-5)
9	Reaction	4	**Antacid** Students learn that stomach acid is hydrochloric acid and recognize heartburn as an uncomfortable condition related to the presence of excess stomach acid. Students plan an experiment to discover the action of antacid tablets when mixed which acid and go on to determine the effectiveness of antacids to neutralize stomach acid. The products of the reaction are determined, and the volume of stomach acid neutralized by one tablet is calculated.	1	--A chemical reaction is a process in which the atoms of substances (reactants) rearrange to form new substances (products). -Acid is neutralized when it is changed into new substances as a result of a reaction.	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.	PS1.A: Structure and Properties of Matter-Each pure substance has characteristic physical and chemical properties that can be used to identify it. (MS-PS1-2). 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).	Patterns-Microscopic patterns are related to the nature of microscopic and atomic-level structure.
10	More Reactions	1	**Citric Acid and Baking Soda** Students work with baking soda and two citric acid solutions, one twice as concentrated as the other. Using the syringe-and-bottle system, they compare the volumes of gas evolved with equal volumes of the two solutions. They discover that the quantity of product is directly related to the reactant that is present in the least quantity, the limiting factor.	2	-The quantities of reactants available at the start of a reaction determine the quantities of products. -The limiting factor is the reactant present in the lowest concentration.	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.	PS1.A: Structure and Properties of Matter-Each pure substance has characteristic physical and chemical properties that can be used to identify it. (MS-PS1-2). 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).	Patterns-Microscopic patterns are related to the nature of microscopic and atomic-level structure.
10	More Reactions	2	**Rust** Students put wet steel wool into a 50-mL graduated cylinder and then invert the cylinder in water. After a day they observe that the water has encroached 10-11 mL into the cylinder. The percentage of air reduction is equal to the percentage of oxygen in the air. Students consider rusting as a reaction between iron and oxygen. The new product is a solid called rust.	3	-Rusting is a reaction between atmospheric oxygen and iron. -Reactants that remain in their original form after a reaction has run to completion were present in excess.	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.	PS1.A: Structure and Properties of Matter-Each pure substance has characteristic physical and chemical properties that can be used to identify it. (MS-PS1-2). 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	Patterns-Microscopic patterns are related to the nature of microscopic and atomic-level structure.

							new substances have different properties from those of the reactants. (MS-PS1-2).	

Bloomingdale School District

Bloomingdale, NJ

Science
Grade 8

Adopted: September

2015

Grade 8 Science is aligned to the NJSLS-S which are correlated to the NJSLS-ELA and NJSLS-M. There is a focus on learning science through investigation and through reading non-fiction texts and inquiry-based science exploration.

Science Department

Grade 8: Life Science

Unit Name: Diversity of Life	
Essential Questions: ● How are living things different from non-living things? ● How are the structures (parts) of living things related to their functions? ● How are living things composed of cells? ● What must all living things do or have in order to survive? ● How are living things similar to each other and how are they different? ● How can we learn more about living things? ● What characteristics do living organisms share? ● How do scientists classify all of the organisms on Earth?	
Investigation 1	**What is Life?**
	Students learn about characteristics that are common to all living organisms in order to develop an operational definition of life. They categorize living/non-living groups and investigate unknown materials by placing them in aquatic environments and observing them for evidence of life. They learn that living organisms grow, consume nutrients, exchange gases, respond to stimuli, reproduce, need water, and eliminate waste.
Investigation 2	**Introduction to the Microscope**
	Students develop skills by means of scientific technology, using a microscope to observe and study microorganisms. They draw representations of images seen in a microscope and learn the components of the tool to assist in their study of microorganisms. They study layers in a sample and apply their understanding of structures of brine shrimp to determine functionality.
Investigation 3	**Microscopic Life**
	Students discover cells and begin to understand their importance as basic units of life. Structure-function relationships become apparent in their in depth observations of microorganisms. They generate evidence to support the idea that paramecia are organisms and critically compare/contrast other organisms in their studies. Kingdom Protista is studied to help differentiate between unicellular and multicellular organisms.
Investigation 4	**The Cell**
	Students compare and contrast structures and functions of cells from different organisms and determine relationships within the system, learning about the parts and how they represent the whole. Cell organelles covered: cell membrane, cytoplasm, nucleus, nucleolus, endoplasmic reticulum, vacuole,ribosomes, golgi body, lysosome, cell wall, chloroplast. Students create a project that involves an analogy that illustrates the interaction of cell organelles.
Investigation 5	**Ribbon of Life**
	Students become familiar with biological structures and functions at different levels of organization: cells, organs, tissues, organ systems, and whole organisms. The circulatory, excretory, digestive, respiratory, muscular, and nervous systems are explored to see how higher level organisms maintain homeostasis. Unicellular and multicellular organisms are compared to see that unicellular organisms only reach "cell" in their ribbon of life.
Investigation 6	**Kingdoms of Life**
	Through a study of bacteria and fungi students are introduced to the great diversity of microorganisms. They use lab procedures to inoculate agar plates with bacteria and fungi, make observations, collect and analyze data, and make comparisons between living organisms studies throughout the unit. An introduction to the system of kingdoms of life assists students in understanding diversity of organisms.
Investigation 7	**Classification**
	Students become familiar with Linnaeus' classification system and are introduced to some of the early scientists who developed theories about living things. Students classify living organisms into a seven level classification system from most broad to most specific characteristics. Students figure out an organism's scientific name from the final two levels genus and species. Through activities students act as scientists to speak in common terminology and name organisms by their scientific name.

NGSS Performance Expectations Addressed	**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. **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. **MS-LS1-3.** Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells **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.
Disciplinary Core Ideas Framework	**LS1.A: Structure and Function** ● All living things are made up of cells, which is the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular). **LS1.B: Growth and Development of Organisms** ● Animals engage in characteristic behaviors that increase the odds of reproduction. ● Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction.
Crosscutting Concepts	● Patterns Cause and effect: Mechanism and explanation ● Scale, proportion, and quantity ● Systems and system models ● Energy and matter: flows, cycles, and conservation ● Structure and function ● Stability and change
Science & Engineering Practices	● Asking questions and defining problems ● Developing and using models ● Planning and carrying out investigations ● Analyzing and interpreting data ● Using mathematics and computational thinking ● Constructing explanations ● Engaging in argument from evidence ● Obtaining, evaluating, and communicating information
Assessments	Summing Up Science Bi- Weekly Quizzes, Lab Reports,Unit Tests Projects: Cell Project

Unit Name: Populations & Ecosystems

Essential Questions:

- How is matter transformed, and energy transferred/transformed in living systems beginning with Photosynthesis and cycling through Cellular Respiration?
- What are the functional roles of populations in an ecosystem shown through food webs?
- How can change in one part of an ecosystem affect change in other parts of the ecosystem?
- How do humans impact the diversity and stability of an ecosystem?
- Why is biodiversity important to the stability of an ecosystem?
- How does the understanding of manipulation of genetics, reproduction, development and evolution affect the quality of human life?
- How are organisms of the same kind different from each other? How does this help them to reproduce and survive?
- How does evolution occur?
- How do organisms change over time?
- How does natural selection affect evolution?

Investigation 1	**Sorting out Life**
	Students use ecosystem sorting cards to reflect on organizing concepts in ecology and to develop the vocabulary associated with those concepts. Concepts covered: organism, population, community, ecosystem, biotic, abiotic.
Investigation 2	**Mini Ecosystems**
	Students construct aquatic and terrestrial ecosystems in the classroom and observe them over time to understand ecosystem interactions. They use a group scientific log to observe, describe, and monitor changes in biotic and abiotic factors. Symbiotic relationships are identified- mutualism, commensalism, parasitism. An organism's habitat and niche are differentiated.
Investigation 3	**Mono Lake**
	Students use Mono Lake, an important alkaline lake, as a simple ecosystem case study. They study the functional roles of populations to construct a food web. The roles of producers, consumers, and decomposers are explored to see how energy is transferred through the trophic levels. Consumers are broken down into herbivores, omnivores, and carnivores. Predator- prey relationships are discovered and limiting factors and carrying capacities are explored to understand how ecosystems thrive or fail.
Investigation 4	**Finding the Energy**
	Students learn that food is produced by photosynthetic organisms and explore how food energy moves from one trophic level to another through feeding relationships.Students take knowledge of the cell organelles structures and functions to see how energy originates from the sun and is harnessed by producers via the chloroplast. Students discover the reactants and products of photosynthesis through a lab investigation. Cellular respiration is then explored by burning food to measure the energy. Students learn that photosynthesis and cellular respiration are opposite chemical reactions that abide by the Law of Conservation of Matter. Chemical reactions are reviewed- atoms, elements, compounds,products, reactions, balancing chemical reactions, types of reactions, endothermic, exothermic. Energy from the Sun are reviewed- thermal (radiation, conduction, convection) & light (reflection, refraction, absorption).
Investigation 5	**Ecoscenarios- Biomes Project**
	Working in groups, students use knowledge developed in previous investigations to analyze a specific ecosystem and prepare reports. The FOSS website provides a tool to research ten ecosystems. A Multimedia project is created incorporating food webs, trophic levels, kingdoms, habitats, etc.
Investigation 6	**Adaptations**

	Students are introduced to adaptation first through a video and then by working with a multimedia simulation of a population of walkingsticks that exhibit color variation. Students study the impact of predation on the insects in different environments.
Investigation 7	**Genetic Variation**
	Students investigate the underlying mechanisms of change in populations by breeding an imaginary animal called a larkey. They learn how organisms inherit traits from their parents and how dominant and recessive alleles interact to produce traits in a population. Terms explored- homozygous, heterozygous, allele, gene, dominant, recessive, genotype, phenotype. Punnett Squares are used to determine the probability of traits passed from generation to generation.
Investigation 8	**Natural Selection**
	Students study natural selection in larkeys. They take a video journey to the Galapagos Islands where Charles Darwin gathered data for his theory of natural selection.
NGSS Performance Expectations Addressed	**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. **MS-LS1-3.** Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells. **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. **MS-LS1-5.** Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. **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. **MS-LS2-1**. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. **MS-LS2-2**. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. **MS-LS2-3**. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. **MS-LS2-4**. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. **MS-LS2-5.** Evaluate competing design solutions for maintaining biodiversity and ecosystem services. **MS-LS3-1.** Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism. **MS-LS3-2.** Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation. **MS-LS4-1.** Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past. **MS-LS4-2.** Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships **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-LS4-5.** Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms **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.
Disciplinary Core Ideas Framework	**LS1.C: Organization for Matter and Energy Flow in Organisms** ● Within individual organisms, food moves through a series of chemical reactions in which it is broken down and rearranged to form new molecules, to support growth, or to release energy.LS2.A: Interdependent Relationships in Ecosystems ● Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. ● In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction. ● Growth of organisms and population increases are limited by access to resources.

	LS2.B: Cycle of Matter and Energy Transfer in Ecosystems • Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem. **LS2.C: Ecosystem Dynamics, Functioning, and Resilience** • Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations. **LS1.B: Growth and Development of Organisms** • Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring. *(secondary)* **LS3.A: Inheritance of Traits** • Genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes. Each distinct gene chiefly controls the production of specific proteins, which in turn affects the traits of the individual. Changes (mutations) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits. **LS3.B: Variation of Traits** • In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations. Though rare, mutations may result in changes to the structure and function of proteins. Some changes are beneficial, others harmful, and some neutral to the organism. **LS4.D: Biodiversity and Humans** • Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on—for example, water purification and recycling.*(secondary)* ***LS4.B: Natural Selection*** • *Natural selection leads to the predominance of certain traits in a population, and the suppression of others.* **ETS1.B: Developing Possible Solutions** • There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. *(secondary)* ***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.* **PS3.D: Energy in Chemical Processes and Everyday Life** • Cellular respiration in plants and animals involve chemical reactions with oxygen that release stored energy. In these processes, complex molecules containing carbon react with oxygen to produce carbon dioxide and other materials.*(secondary)*
Crosscutting Concepts	• Patterns Cause and effect: Mechanism and explanation • Scale, proportion, and quantity • Systems and system models • Energy and matter: flows, cycles, and conservation • Structure and function • Stability and change
Science & Engineering Practices	• Asking questions and defining problems • Developing and using models • Planning and carrying out investigations • Analyzing and interpreting data • Using mathematics and computational thinking • Constructing explanations • Engaging in argument from evidence • Obtaining, evaluating, and communicating information
Assessments	Summing Up Science Bi- Weekly Quizzes, Lab Reports, Unit Tests Projects: Biome project, Genetics Project

Unit Name: Brain & Senses	
Essential Questions: ● What is the structure, orientation, and function of the brain and eyes? ● What is the role of the brain in creating meaning out of the sensory signals it receives? ● What is the difference between learning and memory? ● What is the role of sensory, interneurons, and motor neurons in the transmission of a message from stimuli to response? ● Why is it important to study the structure and function of the human body? ● How do all body systems interact to maintain homeostasis?	
Investigation 1	**Learning & Memory** Students investigate learning by trying to learn mirror writing. They test their ability to memorize a set of objects using various single and complex input modes- hearing, seeing, hearing and seeing, etc. They explore mnemonics to enhance memory.
Investigation 2	**Eyes Inside & Out** Students study the external and internal structures of the eye. They inspect their own eyes and that of their partner. They study the pupil's response to light. They study the internal structures by performing a cow eye dissection.
Investigation 3	**Sending a Message** Students test their reaction time to a visual stimulus. They are introduced to the neuron as the basic cell of the nervous system, and to the transmission of messages from neuron the neuron.
Investigation 4	**The Brain** Students become familiar with the three main parts of the brain- brain stem, cerebrum. and cerebellum. Students study MRI images to determine the connection between the eyes and the major parts of the brain. A model is created identifying the lobes of the cerebrum- occipital, parietal, temporal, frontal. The teenage brain is discussed as well as the effects of drugs and alcohol.
Investigation 5	**Dissections** The life science course ends with dissections of worms and frogs. The organs and systems are compared in less complex organisms (worm) and more complex organisms (frog). The circulatory, excretory, digestive, respiratory, muscular, and nervous systems are explored to see how higher level organisms maintain homeostasis
NGSS Performance Expectations Addressed	**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. **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. **MS-LS1-3.** Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells. **MS-LS1-8.** Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories**.**.
Disciplinary Core Ideas Framework	**LS1.A: Structure and Function** ● All living things are made up of cells, which is the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular). **LS1.D: Information Processing** ● Each sense receptor responds to different inputs (electromagnetic, mechanical, chemical), transmitting them as signals that travel along nerve cells to the brain. The signals are then processed in the brain, resulting in immediate behaviors or memories.

Crosscutting Concepts	• Patterns Cause and effect: Mechanism and explanation • Scale, proportion, and quantity • Systems and system models • Energy and matter: flows, cycles, and conservation • Structure and function • Stability and change
Science & Engineering Practices	• Asking questions and defining problems • Developing and using models • Planning and carrying out investigations • Analyzing and interpreting data • Using mathematics and computational thinking • Constructing explanations • Engaging in argument from evidence • Obtaining, evaluating, and communicating information
Assessments	Summing Up Science Bi- Weekly Quizzes, Lab Reports,Unit Tests Projects: Dissections

CURRICULUM ADDENDA FOR SPECIAL EDUCATION

This curriculum can be both grade and age appropriate for special education students and serves as a guide for the special education teacher in line with the district's written philosophy of special education concerning Programs for Educationally Disabled Students. Based on the Child Study Team evaluation and consultation with the parent and classroom teacher, an individualized education plan may include modifications to content, instructional procedures, student expectations, and targeted achievement outcomes of this curriculum document in accordance with the identified individual needs of an eligible student. This educational plan will then become a supplemental guide that the classroom teacher, parent, and Child Study Team will use to measure the individual student's performance and achievement.

CURRICULUM ADDENDA FOR ENGLISH LANGUAGE LEARNERS

This curriculum guide is appropriate and is implemented for all students according to age and grade, and is in line with the district's written philosophy of English language acquisition as stated within Policy #6409 concerning Bilingual Instruction and English as a Second Language Programs. In accordance with the New Jersey Administrative Code 6A:15, the contents herein provide equitable instructional opportunities for English Language Learners to meet the Core Curriculum Content Standards and to participate in all academic and non-academic courses. Students enrolled in a Bilingual and/or an ESL program may, in consultation with the classroom teacher and Bilingual and/or ESL teacher, receive modifications to content, instructional procedures, student expectations and targeted achievement outcomes of this curriculum document in accordance with the students developmental and linguistic needs.

Modifications	**Special Education Students:** How to Adapt Your Teaching Strategies to Student Needs **English Language Learners:** How to adapt lessons for ELL students by Dr. Denise Furlong **Students at Risk of Failure:** Modifications and Accommodations for At Risk Students **Gifted Students:** Gifted Students Modifications

MODIFICATIONS/SUPPLEMENTARY AIDS IN REGULAR EDUCATION FOR SPECIAL EDUCATION STUDENTS

To the maximum extend appropriate, an educationally disabled pupil shall be educated with children who are not educationally disabled. In developing the basic plan of the individual education program, the Child Study Team, Regular Education teacher, Special Education teacher, and parent/guardian shall determine the appropriateness of regular education program options with support, such as curricular or instructional modifications.

The following list is only some of the curricular modifications and instructional techniques available for implementation in the Regular Education classroom.

- Read tests orally, record student response; allow test retakes
- Reduce the amount of written work or class work by one half
- Grade student on what is handed in, do not penalize for incomplete assignments / homework / spelling
- Allow student to finish tests and quizzes during school, after school, or in the Resource Center; allow additional time for tests
- Do not require student to make up work when absent
- Provide preferential seating, study carrels
- Keep desk free from extraneous materials
- Provide adequate space for movement
- Extend time for processing information
- Cue student to stay on task
- Establish an individual daily schedule
- Break work into shorter segments
- Rewriting tests / consider spacing and crowding
- Test for content and knowledge in subject areas
- Grading modification based on individual goals
- Verbal cues and prompts
- Proximity control
- Logical consequences / natural reinforcers / immediate feedback
- Augmentative communication systems (i.e., Alpha Talker)
- Books on tape / study guides
- Differentiated activities / assignments
- Homework Clubs, homework assignment pads
- Vary test formats; short answers, matching, essay
- Alternative response modes: points, writes, circles
- Curriculum-based assessment
- Peer tutoring : Individual and Classwide models
- Cooperative learning groups
- Advance organizers / outlines / study guides / mapping guides
- Note-taking assistance / note-taking strategies
- Rephrasing/redirecting /’preview’ strategies / mnemonic devices
- Computer assisted instruction
- Assistive technology devices
- Math: calculator, tables, number lines, manipulatives
- Vary input: lecture, demonstration, simulations

- Vary output: oral, written games, role plays
- Vary questioning techniques
- Parallel activity or curriculum
- Provide summary of reading assignment: written / taped
- Use checklist for review / study procedures
- Behavioral contingency contracts / planned ignoring
- Time out/ time away
- Rules and Routine clear and consistent

ENGLISH LANGUAGE LEARNERS
GENERAL MODIFICATIONS FOR INSTRUCTIONAL ACTIVITIES

In order to ensure that English Language Learners are fully integrated into classroom life and can participate in all mainstream content areas, certain modifications and differentiated criteria shall be implemented. The following modifications can be utilized to suit the needs of English Language Learners in the mainstream classes outlined in this curriculum guide. After consultation with an ESL/Bilingual teacher and identification of student's proficiency level, the mainstream content area teacher can choose the appropriate strategies. Teachers should:

Beginning ESL students

- Allow students to illustrate answers or vocabulary words
- Allow students to translate vocabulary into native language and use native language dictionary.
- Speak slowly and clearly
- Use gestures, facial expressions, and visuals
- Ask yes/no questions
- Model: use concrete demonstration of abstract concepts
- Use manipulatives, props, pictures, and concrete objectives as much as possible
- Assign a native language partner/peer tutor
- Use study guides/outline chapters
- Monitor use of notebooks
- Differentiated grading and requirements

Beginning and Intermediate ESL students

- Simplify language/avoid idioms
- Use cooperative learning groups/set up peer tutoring pairs to encourage participation
- Use videos to reinforce content
- Tape record lessons and text readings
- Incorporate appropriate student software into planning and assignments
- Highlight key words and concepts
- Reduce the number of items for tests, class work, and homework
- Allow for repetition of material in various modes, (oral, written, visual, song)
- Allow verbal response in place of written
- Use manipulatives and hands-on activities
- Use graphic organizers, Venn diagrams and outlines to visually present information
- Encourage students to organize information through the use of such organizers
- Build background knowledge prior to lesson, students may not be aware of culturally specific events or objects
- Provide multiple choice options for open ended questions
- Use student as a resource whenever possible
- Differentiated grading and requirements

Advanced ESL students and recently exited ESL students (see above as needed)

- Score writing holistically (focus on the content of ideas rather than grammar)
- Use cooperative learning groups/set up peer tutoring pairs
- Highlight key words
- Encourage participation by fostering a supportive class climate and allowing for mistakes
- Use graphic organizers

- Modify and support writing assignments and assessments
- Build background knowledge through class discussions especially if material is culturally specific to the United States
- Use student as a resource whenever possible/highlight student successe

CAREER INFUSION

I. AWARENESS OF SELF

A. Becomes aware of personal characteristics including strengths and limitations
1. Considers careers in terms of strengths and limitations
2. Accurately describes own scholastic abilities

B. Identifies a preferred life style
1. Understands that careers are related to life style
2. Identifies from a variety of life styles those most compatible with personal characteristics and needs.

C. Relates personal needs, values, and interests to behavior decisions and careers
1. Explores personal interests.
2. Explores careers in terms of interests and abilities.
3. Understands that one's career can combine skills and interests.

II IMPROVE HUMAN RELATIONSHIPS, INCREASE INTERPERSONAL SKILLS

A. Reacts positively to constructive criticism.
1. Gives and profits from constructive criticism.
2. Use information gained through constructive criticism to effect change in self and others.

B. Works with others regardless of sex, race, or cultural differences.

C. Affirms the need for positive interpersonal relationships.
1. Uses positive means for working with others.
2. Assumes an active role in group situations.
3. Understands the need for and maintains open communication.

III. IIMPROVE CAREER PLANNING AND DECISION-MAKING SKILLS

A. Able to use decision-making processes.
1. Obtains adequate and relevant information for decisions.
2. Uses information sources effectively in making decision.

B. Demonstrates the ability to participate in group decision-making.
1. Identifies the kinds of decisions that are made in groups.
2. Participates effectively in group decision-making.

IV. IMPROVE WORK, ATTITUDES, AND APPRECIATION FOR CAREER SUCCESS

A. Demonstrates initiative and independence
1. Engages in activities independently.
2. Engages in independent study and independent tasks.

B. Exhibits positive work attitude.
1. Identifies ways in which occupation, jobs, and work situations can be personally satisfying.
2. Identifies ways in which workers can improve their work in terms of satisfaction.

C. Plans and completes tasks efficiently and thoroughly.
1. Demonstrates self-discipline in completing tasks.
2. Values planning in organizing work and completing jobs.

D. Uses health and safety habits.
1. Explores safety aspects of jobs.
2. Evidences concern for safety of self and others.

V. IMPROVE PROFICIENCY OF COMMUNICATION AND COMPUTATIONAL SKILLS

A. Understand how good listening skills apply to careers explored.

B. Uses writing and speaking skills effectively.

1. Uses writing and speaking skills in and out of school.
2. Uses diverse writing and speaking skills effectively.

VI. GAIN KNOWLEDGE OF THE CAREER IMPLICATION OF SUBJECT MATTER

A. Identifies career implication of school experiences.

1. Explores careers and plans school experiences in terms of personal interests and skills already learned.
2. Applies course content to career interests.

B. Relates specific school experiences to job requirements.

1. Understand career implication of specific subject matter.
2. Explores career in terms of educational requirements.

VII. ACQUIRE AND APPLY SOCIO-TECHNOLOGICAL-ECONOMIC-POLITICAL UNDERSTANDING

A. Evidences technological understanding.

1. Traces impact of technology on careers explored
2. Acquires skills needed to work with technologies related to preferred Occupations

VIII. INCREASE KNOWLEDGE OF CAREER AND OCCUPATIONAL INFORMATION

A. Uses knowledge of personal values, interest, needs, and limitations to explore career options by relating personal characteristics to preferred occupations.

B. Develop awareness of a range of career options and their requirements by developing skills which can be combined in a number of ways in different careers.

IX. MARKETABLE SKILLS AND ADAPTABILITY

A. Understands effects of technological change.

1. Explores emerging careers and occupations.
2. Considers implications of future technological change on preferred occupations.

X. LEISURE PREFERENCES

A. Identifies personal leisure preferences.

1. Relates values and interests to use of leisure time.
2. Evaluates leisure activities in terms of personal values and goals.

B. Describes the role of leisure in living: pleasure, personal, social, intellectual development, health, and fitness.

1. Assesses the value of hobbies and activities in personal development.
2. Values leisure activities.

XI. CAREER DAY

A. Students in Grades 5-8 will participate in Career Day which will involve them in projects, interviews, resume writing, etc.

INTERDISCIPLINARY CONNECTIONS
AND ALIGNMENT TO TECHNOLOGY STANDARDS

2014 New Jersey Core Curriculum Content Standards – Technology

Content Area	**Technology**		
Standard	**8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.**		
Strand	**A. Technology Operations and Concepts:** *Students demonstrate a sound understanding of technology concepts, systems and operations.*		
Grade Level bands	**Content Statement Students will:**	**Indicator**	**Indicator**
P	Understand and use technology systems.	8.1.P.A.1	Use an input device to select an item and navigate the screen
		8.1.P.A.2	Navigate the basic functions of a browser.
	Select and use applications effectively and productively.	8.1.P.A.3	Use digital devices to create stories with pictures, numbers, letters and words.
		8.1.P.A.4	Use basic technology terms in the proper context in conversation with peers and teachers (e.g., camera, tablet, Internet, mouse, keyboard, and printer).
		8.1.P.A.5	Demonstrate the ability to access and use resources on a computing device.
K-2	Understand and use technology systems.	8.1.2.A.1	Identify the basic features of a digital device and explain its purpose.
	Select and use applications effectively and productively.	8.1.2.A.2	Create a document using a word processing application.
		8.1.2.A.3	Compare the common uses of at least two different digital applications and identify the advantages and disadvantages of using each.
		8.1.2.A.4	Demonstrate developmentally appropriate navigation skills in virtual environments (i.e. games, museums).
		8.1.2.A.5	Enter information into a spreadsheet and sort the information.
		8.1.2.A.6	Identify the structure and components of a database.
		8.1.2.A.7	Enter information into a database or spreadsheet and filter the information.
3-5	Understand and use technology systems.	8.1.5.A.1	Select and use the appropriate digital tools and resources to accomplish a variety of tasks including solving problems.
	Select and use applications effectively and productively.	8.1.5.A.2	Format a document using a word processing application to enhance text and include graphics, symbols and/ or pictures.
		8.1.5.A.3	Use a graphic organizer to organize information about problem or issue.

		8.1.5.A.4	Graph data using a spreadsheet, analyze and produce a report that explains the analysis of the data.
		8.1.5.A.5	Create and use a database to answer basic questions.
		8.1.5.A.6	Export data from a database into a spreadsheet; analyze and produce a report that explains the analysis of the data.
6-8	Understand and use technology systems.	8.1.8.A.1	Demonstrate knowledge of a real world problem using digital tools.
	Select and use applications effectively and productively.	8.1.8.A.2	Create a document (e.g. newsletter, reports, personalized learning plan, business letters or flyers) using one or more digital applications to be critiqued by professionals for usability.
		8.1.8.A.3	Use and/or develop a simulation that provides an environment to solve a real world problem or theory.
		8.1.8.A.4	Graph and calculate data within a spreadsheet and present a summary of the results
		8.1.8.A.5	Create a database query, sort and create a report and describe the process, and explain the report results.

Content Area	**Technology**
Standard	**8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.**
Strand	**B. Creativity and Innovation:** *Students demonstrate creative thinking, construct knowledge and develop innovative products and process using technology.*

Grade Level bands	Content Statement Students will:	Indicator	Indicator
P	Apply existing knowledge to generate new ideas, products, or processes. Create original works as a means of personal or group expression.	8.1.P.B.1	Create a story about a picture taken by the student on a digital camera or mobile device.
K-2		8.1.2.B.1	Illustrate and communicate original ideas and stories using multiple digital tools and resources.
3-5		8.1.5.B.1	Collaborative to produce a digital story about a significant local event or issue based on first-person interviews.
6-8		8.1.8.B.1	Synthesize and publish information about a local or global issue or event (ex. telecollaborative project, blog, school web).
9-12		8.1.12.B.2	Apply previous content knowledge by creating and piloting a digital learning game or tutorial.

Content Area	**Technology**

Standard	**8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.**
Strand	**C. Communication and Collaboration:** *Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.*

Grade Level bands	**Content Statement**	**Indicator**	**Indicator**
P	Interact, collaborate, and publish with peers, experts, or others by employing a variety of digital environments and media. Communicate information and ideas to multiple audiences using a variety of media and formats. Develop cultural understanding and global awareness by engaging with learners of other cultures. Contribute to project teams to produce original works or solve problems.	8.1.P.C.1	Collaborate with peers by participating in interactive digital games or activities.
K-2		8.1.2.C.1	Engage in a variety of developmentally appropriate learning activities with students in other classes, schools, or countries using various media formats such as online collaborative tools, and social media.
3-5		8.1.5.C.1	Engage in online discussions with learners of other cultures to investigate a worldwide issue from multiple perspectives and sources, evaluate findings and present possible solutions, using digital tools and online resources for all steps.
6-8		8.1.8.C.1	Collaborate to develop and publish work that provides perspectives on a global problem for discussions with learners from other countries.

Content Area	**Technology**
Standard	**8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.**
Strand	**D. Digital Citizenship:** *Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior.*

Grade Level bands	**Content Statement**	**Indicator**	**Indicator**
K-2	Advocate and practice safe, legal, and responsible use of information and technology.	8.1.2.D.1	Develop an understanding of ownership of print and nonprint information.
3-5	Advocate and practice safe, legal, and responsible use of information and technology.	8.1.5.D.1	Understand the need for and use of copyrights.
		8.1.5.D.2	Analyze the resource citations in online materials for proper use.
	Demonstrate personal responsibility for lifelong learning.	8.1.5.D.3	Demonstrate an understanding of the need to practice cyber safety, cyber security, and cyber ethics when using technologies and social media.
	Exhibit leadership for digital	8.1.5.D.4	Understand digital citizenship and

	citizenship.		demonstrate an understanding of the personal consequences of inappropriate use of technology and social media.
6-8	Advocate and practice safe, legal, and responsible use of information and technology.	8.1.8.D.1	Understand and model appropriate online behaviors related to cyber safety, cyber bullying, cyber security, and cyber ethics including appropriate use of social media.
	Demonstrate personal responsibility for lifelong learning.	8.1.8.D.2	Demonstrate the application of appropriate citations to digital content.
		8.1.8.D.3	Demonstrate an understanding of fair use and Creative Commons to intellectual property.
	Exhibit leadership for digital citizenship.	8.1.8.D.4	Assess the credibility and accuracy of digital content.
		8.1.8.D.5	Understand appropriate uses for social media and the negative consequences of misuse.

Content Area	**Technology**
Standard	**8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.**
Strand	**E: Research and Information Fluency:** *Students apply digital tools to gather, evaluate, and use information.*

Grade Level bands	**Content Statement** **Students will:**	**Indicator**	**Indicator**
P	Plan strategies to guide inquiry.	8.1.P.E.1	Use the Internet to explore and investigate questions with a teacher's support.
K-2	Plan strategies to guide inquiry Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media. Evaluate and select information sources and digital tools based on the appropriateness for specific tasks.	8.1.2.E.1	Use digital tools and online resources to explore a problem or issue.
3-5	Plan strategies to guide inquiry. Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media. Evaluate and select information sources and digital tools based on the	8.1.5.E.1	Use digital tools to research and evaluate the accuracy of, relevance to, and appropriateness of using print and non-print electronic information sources to complete a variety of tasks.

	appropriateness for specific tasks.		
6-8	Plan strategies to guide inquiry. Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media. Evaluate and select information sources and digital tools based on the appropriateness for specific tasks. Process data and report results.	8.1.8.E.1	Effectively use a variety of search tools and filters in professional public databases to find information to solve a real world problem.

Content Area	**Technology**
Standard	**8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.**
Strand	**F: Critical thinking, problem solving, and decision making:** *Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.*

Grade Level bands	**Content Statement Students will:**	**Indicator**	**Indicator**
K-2	Identify and define authentic problems and significant questions for investigation. Plan and manage activities to develop a solution or complete a project. Collect and analyze data to identify solutions and/or make informed decisions. Use multiple processes and diverse perspectives to explore alternative solutions.	8.1.2.F.1	Use geographic mapping tools to plan and solve problems.
3-5	Identify and define authentic problems and significant questions for investigation. Plan and manage activities to develop a solution or complete a project. Collect and analyze data to identify solutions and/or make informed decisions. Use multiple processes and diverse perspectives to	8.1.5.F.1	Apply digital tools to collect, organize, and analyze data that support a scientific finding.

	explore alternative solutions		
6-8	Identify and define authentic problems and significant questions for investigation. Plan and manage activities to develop a solution or complete a project. Collect and analyze data to identify solutions and/or make informed decisions. Use multiple processes and diverse perspectives to explore alternative solutions.	8.1.8.F.1	Explore a local issue, by using digital tools to collect and analyze data to identify a solution and make an informed decision.

21st CENTURY LIFE AND CAREERS

9.1 PERSONAL FINANCIAL LITERACY

CONTENT AREA:	***21st CENTURY LIFE AND CAREERS***
STRAND A:	***INCOME AND CAREERS***
NUMBER	**STANDARD STATEMENT**
By the end of Grade 4, students will be able to:	
9.1.4.A.1	Explain the difference between a career and a job, and identify various jobs in the community and the related earnings.
9.1.4.A.2	Identify potential sources of income.
9.1.4.A.3	Explain how income affects spending and take-home pay.
By the end of Grade 8, students will be able to:	
9.1.8.A.1	Explain the meaning and purposes of taxes and tax deductions and why fees for various benefits (e.g., medical benefits) are taken out of pay.
9.1.8.A.2	Relate how career choices, education choices, skills, entrepreneurship, and economic conditions affect income.
9.1.8.A.3	Differentiate among ways that workers can improve earning power through the acquisition of new knowledge and skills.
9.1.8.A.4	Relate earning power to quality of life across cultures.
9.1.8.A.5	Relate how the demand for certain skills determines an individual's earning power.
9.1.8.A.6	Explain how income affects spending decisions.
9.1.8.A.7	Explain the purpose of the payroll deduction process, taxable income, and employee benefits.

9.1 PERSONAL FINANCIAL LITERACY	
CONTENT AREA:	***21st CENTURY LIFE AND CAREERS***
STRAND B:	***MONEY MANAGEMENT***
NUMBER	**STANDARD STATEMENT**
By the end of Grade 4, students will be able to:	

9.1.4.B.1	Differentiate between financial wants and needs.
9.1.4.B.2	Identify age-appropriate financial goals.
9.1.4.B.3	Explain what a budget is and why it is important.
9.1.4.B.4	Identify common household expense categories and sources of income.
9.1.4.B.5	Identify ways to earn and save.
By the end of Grade 8, students will be able to:	
9.1.8.B.1	Distinguish among cash, check, credit card, and debit card.
9.1.8.B.2	Construct a simple personal savings and spending plan based on various sources of income.
9.1.8.B.3	Justify the concept of "paying yourself first" as a financial savings strategy.
9.1.8.B.4	Relate the concept of deferred gratification to [investment,] meeting financial goals, and building wealth.
9.1.8.B.5	Explain the effect of the economy on personal income, individual and family security, and consumer decisions.
9.1.8.B.6	Evaluate the relationship of cultural traditions and historical influences on financial practice.
9.1.8.B.7	Construct a budget to save for long-term, short-term, and charitable goals.
9.1.8.B.8	Develop a system for keeping and using financial records.
9.1.8.B.9	Determine the most appropriate use of various financial products and services (e.g., ATM, debit cards, credit cards, check books).
9.1.8.B.10	Justify safeguarding personal information when using credit cards, banking electronically, or filing forms.
9.1.8.B.11	Evaluate the appropriate financial institutions to assist with meeting various personal financial needs and goals.

9.1 PERSONAL FINANCIAL LITERACY	
CONTENT AREA:	***21st CENTURY LIFE AND CAREERS***
STRAND C:	***CREDIT AND DEBT MANAGEMENT***
NUMBER	**STANDARD STATEMENT**
By the end of Grade 4, students will be able to:	
9.1.4.C.1	Explain why people borrow money and the relationship between credit and debt.

9.1.4.C.2	Identify common sources of credit (e.g., banks, credit card companies) and types of credit (e.g., loans, credit cards, mortgages).
9.1.4.C.3	Compare and contrast credit cards and debit cards and the advantages and disadvantages of using each.
9.1.4.C.4	Determine the relationships among income, expenses, and interest.
9.1.4.C.5	Determine personal responsibility related to borrowing and lending.
9.1.4.C.6	Summarize ways to avoid credit problems.
By the end of Grade 8, students will be able to:	
9.1.8.C.1	Compare and contrast credit cards and debit cards and the advantages and disadvantages of using each.
9.1.8.C.2	Compare and contrast the financial products and services offered by different types of financial institutions.
9.1.8.C.3	Compare and contrast debt and credit management strategies.
9.1.8.C.4	Demonstrate an understanding of the terminology associated with different types of credit (e.g., credit cards, installment loans, mortgages) and compare the interest rates associated with each.
9.1.8.C.5	Calculate the cost of borrowing various amounts of money using different types of credit (e.g., credit cards, installment loans, mortgages).
9.1.8.C.6	Determine ways to leverage debt beneficially.
9.1.8.C.7	Determine potential consequences of using "easy access" credit (e.g., using a line of credit vs. obtaining a loan for a specific purpose).
9.1.8.C.8	Explain the purpose of a credit score and credit record, and summarize borrowers' credit report rights.
9.1.8.C.9	Summarize the causes and consequences of personal bankruptcy.
9.1.8.C.10	Determine when there is a need to seek credit counseling and appropriate times to utilize it.

9.1 PERSONAL FINANCIAL LITERACY
21st CENTURY LIFE AND CAREERS
PLANNING, SAVING, AND INVESTING
STANDARD STATEMENT
By the end of Grade 4, students will be able to:
Determine various ways to save.
Explain what it means to "invest."

Distinguish between saving and investing.
By the end of Grade 8, students will be able to:
Determine how saving contributes to financial well-being.
Differentiate among various savings tools and how to use them most effectively.
Differentiate among various investment options.
Distinguish between income and investment growth.

9.1 PERSONAL FINANCIAL LITERACY	
CONTENT AREA:	***21st CENTURY LIFE AND CAREERS***
STRAND E:	***BECOMING A CRITICAL CONSUMER***
NUMBER	**STANDARD STATEMENT**
By the end of Grade 4, students will be able to:	
9.1.4.E.1	Determine factors that influence consumer decisions related to money.
9.1.4.E.2	Apply comparison shopping skills to purchasing decisions.
By the end of Grade 8, students will be able to:	
9.1.8.E.1	Explain what it means to be a responsible consumer and the factors to consider when making consumer decisions.
9.1.8.E.2	Identify personal information that should not be disclosed to others and the possible consequences of doing or not doing so.
9.1.8.E.3	Compare and contrast product facts versus advertising claims.
9.1.8.E.4	Prioritize personal wants and needs when making purchases.
9.1.8.E.5	Analyze interest rates and fees associated with financial services, credit cards, debit cards, and gift cards.
9.1.8.E.6	Compare the value of goods or services from different sellers when purchasing large quantities and small quantities.
9.1.8.E.7	Evaluate how fraudulent activities impact consumers, and justify the creation of consumer protection laws.
9.1.8.E.8	Recognize the techniques and effects of deceptive advertising.

9.1 PERSONAL FINANCIAL LITERACY	
CONTENT AREA:	***21st CENTURY LIFE AND CAREERS***
STRAND F:	***CIVIC FINANCIAL RESPONSIBILITY***
NUMBER	**STANDARD STATEMENT**

	By the end of Grade 4, students will be able to:
9.1.4.F.1	Demonstrate an understanding of individual financial obligations and community financial obligations.
9.1.4.F.2	Explain the roles of philanthropy, volunteer service, and charitable contributions, and analyze their impact on community development and quality of living.
	By the end of Grade 8, students will be able to:
9.1.8.F.1	Explain how the economic system of production and consumption may be a means to achieve significant societal goals.
9.1.8.F.2	Examine the implications of legal and ethical behaviors when making financial decisions.
9.1.8.F.3	Relate the impact of business, government, and consumer fiscal responsibility to the economy and to personal finance.

9.1 PERSONAL FINANCIAL LITERACY	
CONTENT AREA:	***21st CENTURY LIFE AND CAREERS***
STRAND G:	***INSURING AND PROTECTING***
NUMBER	**STANDARD STATEMENT**
	By the end of Grade 4, students should be able to:
9.1.4.G.1	Describe how valuable items might be damaged or lost and ways to protect them.
	By the end of Grade 8, students will be able to:
9.1.8.G.1	Explain why it is important to develop plans for protecting current and future personal assets against loss.
9.1.8.G.2	Determine criteria for deciding the amount of insurance protection needed.
9.1.8.G.3	Analyze the need for and value of different types of insurance and the impact of deductibles.
9.1.8.G.4	Evaluate the need for different types of extended warranties.

9.2 CAREER AWARENESS, EXPLORATION, AND PREPARATION	
CONTENT AREA:	***21st CENTURY LIFE AND CAREERS***
STRAND A:	***CAREER AWARENESS***
NUMBER	**STANDARD STATEMENT**

By the end of Grade 4, students will be able to:	
9.2.4.A.1	Identify reasons why people work, different types of work, and how work can help a person achieve personal and professional goals.
9.2.4.A.2	Identify various life roles and civic and work-related activities in the school, home, and community.
9.2.4.A.3	Investigate both traditional and nontraditional careers and relate information to personal likes and dislikes.
9.2.4.A.4	Explain why knowledge and skills acquired in the elementary grades lay the foundation for future academic and career success.

9.2 CAREER AWARENESS, EXPLORATION, AND PREPARATION	
CONTENT AREA:	***21st CENTURY LIFE AND CAREERS***
STRAND B:	***CAREER EXPLORATION***
NUMBER	**STANDARD STATEMENT**
By the end of Grade 8, students will be able to:	
9.2.8.B.1	Research careers within the 16 Career Clusters® and determine attributes of career success.
9.2.8.B.2	Develop a Personalized Student Learning Plan with the assistance of an adult mentor that includes information about career areas of interest, goals and an educational plan.
9.2.8.B.3	Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.
9.2.8.B.4	Evaluate how traditional and nontraditional careers have evolved regionally, nationally, and globally.
9.2.8.B.5	Analyze labor market trends using state and federal labor market information and other resources available online.
9.2.8.B.6	Demonstrate understanding of the necessary preparation and legal requirements to enter

	the workforce.
9.2.8.B.7	Evaluate the impact of online activities and social media on employer decisions.