Hillside Township School District

Science Curriculum

Grades 6-8

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District Mission Statement

The mission of the Hillside Public Schools is to ensure that all students at all grade levels achieve the Next Generation Science Standards and make connections to real-world success. We are committed to strong parent-community school partnerships, providing a safe, engaging, and effective learning environment, and supporting a comprehensive system of academic and developmental support that meets the unique needs of each individual.

Academic Area Overview

The Hillside Township School District is committed to excellence. We believe that all children are entitled to an education that will equip them to become productive citizens of the twenty-first century. We believe that an education grounded in the fundamental principles of science will provide students with the skills and content necessary to become our future leaders.

A sound science education is grounded in the principles of inquiry and rigor. Children are actively engaged in learning as they model real-world scientific behaviors to construct knowledge. They have ample opportunities to manipulate materials in ways that are developmentally appropriate to their age. They work in an environment that encourages them to take risks, think critically, and make models, note patterns and anomalies in those patterns. Children are encouraged to ask questions, not just the "how" and the "what" of observed phenomena, but also the "why".

Our program provides teachers with cost-effective science materials that are aligned to state and national standards, incorporate instructional strategies that are research-based, and provides teachers with a deep understanding of science and the pedagogical underpinnings of science. Our teachers receive quality professional development through a partnership with nearby districts. Our K-8 kit based program encourages "hands-on science" and is endorsed by the National Science Foundation.

Equality and Equity in Curriculum

The Hillside Township School District ensures that the district's curriculum and instruction are aligned to the Next Generation Science Standards and addresses the elimination of discrimination and the achievement gap, as identified by underperforming school-level AYP reports for State assessment, by providing equity in educational programs and by providing opportunities for students to interact positively with others regardless of race, creed, color, national origin, ancestry, age, marital status, affectional or sexual orientation, gender, religion, disability or socioeconomic status.

N.J.A.C. 6A:7-1.7(b): Section 504, Rehabilitation Act of 1973; N.J.S.A. 10:5; Title IX, Education Amendments of 1972

Next Generation Science Standards

In 2014, NJ adopted the Next Generation Science Standards with the goal of ensuring our students graduate ready for college and career. The standards for science practice describe varieties of expertise that science educators at all levels should seek to develop in their students. These practices rest on important "processes and proficiencies" with longstanding importance in science education. The Science Framework emphasizes process standards of which include planning investigations, using models, asking questions and communicating information. Crosscutting concepts have value because they provide students with connections and intellectual tools that are related across the differing areas of disciplinary content and can enrich their application of practices and their understanding of core ideas. Throughout the year, students should continue to develop proficiency with the eight science practices. Crosscutting concepts can help students better understand core ideas in science and engineering. When students encounter new phenomena, whether in a science lab, field trip, or on their own, they need mental tools to help engage in and come to understand the phenomena from a scientific point of view. Familiarity with crosscutting concepts can provide that perspective. A next step might be to simplify the phenomenon by thinking of it as a system and modeling its components and how they interact. These preliminary studies may suggest explanations for the phenomena, which could be checked by predicting patterns that might emerge if the explanation is correct, and matching those predictions with those observed in the real world. More information regarding the Next Generation Science Standards can be found at: http://www.nextgenscience.org/

Honors Science Courses at WOK Middle School

All science department courses at WOK School prepare students with the knowledge and critical thinking skills necessary for study at the college High School level. The Honors Science courses are designed to support students seeking an additional challenge in their middle school coursework, leading to the pursuit of STEM career paths. These honors courses stress the intellectual role of the student as they grapple with key concepts of science in increased depth. Emphasis will be on the analysis and application of data to make sense of major scientific concepts and principles. Students will learn by designing experiments, performing independent research, and working with models of systems at the nanoscopic, microscopic, and macroscopic levels. To be successful in an Honors Science course, a student must be prepared to work both independently and cooperatively inside and outside of class. Students will also be required to apply more rigorous mathematical skills in Honors science, so it is recommended that students electing to take Honors Science courses have strong grades in their Math coursework. Students succeeding in Honors Science courses are prepared for success at the honors level the following year in the corresponding discipline.

- ***In this document, the Honors Level components are indicated in italicized purple text.***

6-8 Science Program Overview: Units by Grade Level

	Life Science	Physical Science	Earth Science
6	Diversity of Life	Waves	Weather and Water
7	Populations and Ecosystems	Electromagnetic Force & Gravity Kinetic Energy	Planetary Science
8	Heredity and Adaptation & Human System Interactions	Chemical Interactions	Earth History

Science Kit Pacing Grades 6-8

Grade Level	First Kit	Second Kit	Third Kit	Fourth Kit
6	**Weather and Water** Begins: September Ends: December	**Waves** Begins: February Ends March	**Diversity of Life** Begins: March Ends: June	**Variable and Designed** (Added 2018)
7	**Planetary Science** Begins: September Ends: December	**Electromagnetic Force** Begins: January Ends: February	**Gravity Kinetic Energy** Begins: March Ends: April	**Populations and Ecosystems** Begins: April Ends: June

8	**Chemical Interactions** Begins: September Ends: January	**Earth History** Begins: January Ends: March	**Heredity and Adaptation** Begins: March Ends: April	**Human System Interactions** Begins: April Ends: June

Science Department Lesson Plan Template

Lesson Information

Lesson Name: _____
Unit: _____
Date: _____

Lesson Data

1.	Essential Question:	
2.	NGSS Performance Expectation	*Students will be able to…*
3.	Disciplinary Core Idea :	*Students will know……*

4. Practices:

Students will be able to…..

5. Crosscutting Concepts:

Students will apply…

6. Assessment:

Evidence of student learning:

7. Lesson Agenda:

Include in Lesson Outline:

- *Anticipated timing*
- *DO NOW*
- *Activities and Investigations*
- *Discussion prompts*
- *Journal writing prompts*
- *Student uses of technology*
- *Safety precautions*
- *Materials*

8. Homework:

Science

Grade 6

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UNIT:__Weather and Water_____
Grade 6

ENDURING UNDERSTANDINGS	ESSENTIAL QUESTIONS
✓ The Earth can be separated into various spheres which interact dynamically. ✓ The Sun is the ultimate energy source for all of Earth's processes. ✓ Important molecules circulate through Earth's spheres. ✓ Climate is a long-term pattern of temperature and moisture conditions.	✓ How do Earth's systems work? ✓ Where does energy go? ✓ Where does matter go? How are climate and weather related?

NGSS	KNOWLEDGE Students will know:	SKILLS & PRACTICES Students will be able to:	Cross Cutting Concepts Students will apply:
MS-ESS2-4 MS-ESS2-5	**Atmosphere**	● Generate inquiry questions stimulated by the video and discussions.	● Cause and effect ● Systems and system models

MS-ESS3-2 MS-PS1-4 MS-ESS2-6	• Weather is the condition of the Earth's atmosphere at a given time and place. These conditions include temperature, pressure, humidity, wind direction, and wind speed. • Severe weather has the potential to cause death and destruction in the environment. • The Earth is surrounded by an atmosphere composed of a mixture of nitrogen, oxygen, and trace gases that include water vapor. Weather occurs in the lowest layer (troposphere). • The air in our atmosphere is matter; it has mass and occupies space. The air in our atmosphere has different physical and chemical composition at different elevations. • Pressure exerted on a gas reduces its volume and increases its density. • 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 Key Terms: atmosphere, weather, temperature, pressure, humidity, wind direction, wind speed, matter, mass, air pressure, troposphere, nitrogen, oxygen, helium, carbon dioxide, water vapor, isobars	• Use weather instruments to accurately measure temperature, atmospheric pressure, humidity, wind direction, and wind speed and use the media tools to track weather in another city • Analyze data collected by weather balloons launched • Design a procedure that will demonstrate that air has mass • Model and compare the behavior of gasses under various pressure conditions • Recognize the gasses prevalent in our atmosphere • Model the vertical structure of the atmosphere using real-world data from active and passive remote-sensing tools (e.g., satellites, balloons, and/or ground-based sensors) • Apply understanding of atmospheric conditions to authentic scenarios • Investigate the effect of air pressure on the system and consider how density is affected by air pressure • Locate high and low pressure airs on maps and predict where winds will blow and in what direction	• Patterns • Stability and change
MS-ESS2-6 MS-ESS1-1	**Energy and Matter**	• Use a laboratory thermometer to take accurate temperature readings	• Systems and system models • Cause and effect

MS-PS1-4 MS-PS3-4	• The Sun is the major source of energy for causing the circulating movements of the atmosphere and oceans. Energy from the sun is transferred to air, land, and water through radiation. Different substances absorb heat at different rates (differential heating). • Heat energy can move between objects or substances by conduction. This process allows heat energy to transfer from the land to the air. • The density of an object or substance can be determined from its volume and mass. (d = m/v) Adding salt to water (as happens in a marine environment) will change its density. • Sinking and floating can be predicted using forces that depend on the relative densities of the objects and materials. Less dense substances will float or layer above more dense substances. • Heat energy causes matter to expand and become less dense. By changing the density of the matter, the sinking and floating behaviors are also changed. In the ocean, warm masses rise and cool masses sink, causing water to circulate. This energy-driven circulation is called convection. • Circulation of water in marine environments is dependent on factors such as the	• Setup and collect and analyze the data from earth materials in the sun and in the shade • Use evidence to create explanations about the differential heating of solids and liquids on the Earth by the Sun • Design and conduct experiments to observe heat transfer by conduction through solids and liquids. • Make claims about conduction in the environment based on evidence and reasoning. • Relate the transfer of heat from oceans and land masses to the evolution of a hurricane • Explain density as a ratio between a mass and its volume • Use mass and volume values to calculate density • Observe and make claims about the relative densities of liquids in a layered column • Predict whether an object or substance will sink or float (layering above or below in the case of a liquid) in a liquid based on the relative densities of the materials • Apply density concepts to salt solutions in marine environments • Generate a conclusion about energy transfer and circulation by observing	• Scale, proportion and quantity • Energy and matter • Patterns

	composition of water masses and energy from the sun or wind. ● Heat energy carried by ocean currents and transferred during interactions with land and atmosphere has a strong influence on climate around the world. ● The transfer of thermal energy by conduction, convection, and radiation can produce large-scale events such as those seen in weather. Key Terms: heat energy, radiation, differential heating, conduction, mass, volume, density, marine, sink, float, convection	models of convection currents in water and in air ● Explain how energy transfer drives the process of convection ● Apply the concept of convection to explain the circulation of water and air around the globe. ● Represent and explain, using sea surface temperature maps, how ocean currents impact the climate of coastal communities ● Apply concepts of density, radiation, conduction, and convection to authentic scenarios	
MS-ESS2-5 MS-PS1-4 MS-ESS2-6 MS-PS3-4	**Air Pressure and Wind** ● Air moves from areas of high pressure to areas of low pressure. ● Breezes blow in predictable ways determined by local patterns of differential heating from the Sun's radiation being absorbed by air, land and water that in turn causes differences in pressure and density. ● Pressure exerted on a gas reduces its volume and increases its density. ● Wind is a large scale movement of air. ● Air pressure is represented on a map by contour lines called isobars. ● Energy can move from one material to another by conduction.	● Collect and interpret data to build an explanation of the relationship between pressure and density ● Investigate the effect of air pressure on the system and consider how density is affected by air pressure. ● Use a barometer to determine air pressure ● Model the creation of wind in the atmosphere, accounting for differential heating, energy transfer, convection, changes in density, changes in atmospheric pressure, and wind	● Stability and change ● Cause and effect ● Systems and system models ● Patterns ● Energy and Matter

	● Convectional cells and Earth's rotation determine prevailing winds on Earth. <u>Key Terms:</u> pressure, wind, breeze, differential heating, radiation, temperature, density, Coriolis effect	● Explain how energy from the Sun is transformed or transferred in global wind circulation ● Illustrate global winds and surface currents through the creation of a world map of global winds and currents that explains the relationship between the two factors ● Compare data to their models and determine that convection cells and the Coriolis Effect are responsible for the wind patterns on Earth. ● Apply understanding of air pressure and wind to authentic scenarios	

MS-ESS2-4 MS-PS1-4 MS-ESS2-6 MS-PS3-4	**Water** ● Water exists in the atmosphere in the form of water vapor. ● The atmosphere can only hold a certain percentage of water vapor before it becomes full (saturated). Relative humidity is the amount of water vapor in the air expressed as a percentage of saturation. ● Dew point is the temperature at which the air is saturated with water vapor. Above this temperature, liquid water will evaporate to form water vapor. Below this temperature, water vapor will condense to form liquid water droplets. ● Pressure and temperature are related. As pressure increases, temperature increases. As pressure decreases, temperature decreases. ● Air pressure drops as elevation increases, so a mass of air will cool as it ascends. This cooling of air encourages water vapor to condense to form clouds. If enough liquid water condenses, precipitation occurs ● Water also exists in liquid and solid forms around the Earth. Most of Earth's liquid water is salt water in the oceans. Fresh water is found in many locations, including lakes, rivers, and groundwater. Ice is located in glaciers.	● Design and conduct an experiment, collect and analyze data, and make and communicate arguments to support the concept that water vapor exists in the air ● Measure changes in temperature due to evaporation ● Determine dew point temperature at which no more water can evaporate because the air is saturated ● Explain relative humidity as the percentage of water vapor in the air compared to the amount of water vapor needed to saturate that air at a specific temperature ● Predict the evaporation and condensation of water using temperature, humidity, and dew point data ● Investigate the relationship between pressure and temperature, using 2L plastic bottles and thermometer strips ● Observe changes in temperature due to pressure change and build explanations of how pressure changes then affect the behavior of water vapor ● Use pressure to produce a cloud in a bottle. Use this model to build explanations of how clouds are formed in our atmosphere	● Systems and system models ● Cause and effect ● Patterns ● Energy and Matter ● Scale. Proportion and quantity ● Stability and change

	• In the water cycle, water moves between all of these locations through the processes of evaporation, condensation, and precipitation. There is not one set path for each water particle. It follows many different paths over time. • Ocean currents are caused primarily by winds. Convection of ocean water, and the Coriolis Effect. • A location's proximity to a large body of water generally results in less temperature variation and more precipitation Key Terms: water vapor, saturated, relative humidity, dew point, evaporation, condensation, pressure, temperature, precipitation, water cycle	• Predict cloud formation by analyzing sounding data • Trace a water molecule as it takes multiple pathways in the water cycle • Apply understandings of evaporation, condensation, and precipitation to explain the workings of the water cycle. Explain how energy from the Sun drives the processes within the cycle • Apply understanding of water behaviors to authentic scenarios	
MS-ESS3-5 MS-ESS2-4 MS-PS1-4 MS-ESS2-6 MS-ESS2-5 MS-ESS3-2	**Weather and Climate Change** • Air in the atmosphere moves in large bodies (air masses) that are uniform in temperature and humidity. These air masses are separated by boundaries called fronts. • The difference between temperature and humidity of the two air masses (due to the cycling of heat and water in and out of the atmosphere) causes weather conditions to change at the location of the front as it moves across the Earth.	• Model the formation of an air mass and use the model to describe its behavior • Compare and classify different air masses • Model frontal boundaries to explain what happens when two air masses of different densities meet, relating it to their differences in density • Determine the origin of local weather by exploring national and international weather maps	• Cause and effect • Patterns • System and system models • Energy and Matter • Stability and change

	● 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. ● When greenhouse gas concentrations in the atmosphere increase, the global temperature rises. ● Humans impact the atmosphere with chemical pollutants, including greenhouse gases and particulates that have been linked to global warming. Global warming may have an effect on Earth's weather and climate. <u>Key Terms:</u> air masses, front, climate, greenhouse gas, global warming	● Explain the interrelationships between daily temperature, air pressure, and humidity data ● Explain the mechanisms that cause varying daily temperature ranges in a coastal community and in a community located in the interior of the country ● Explain how a global temperature increase could affect the water cycle and Earth's climate ● Use computer simulations to explore the effects of carbon dioxide and other greenhouse gases in the atmosphere. ● Analyze climate graphs for four different geographical locations and look for changes over a 50 year period. ● Evaluate the impact of daily life choices on Earth's atmosphere and the consequences of a changing atmosphere ● Read summaries of news stories from the past decade, looking for evidence of climate change and whether that change is caused by humans ● Apply understanding of weather and climate to authentic scenarios	

Weather and Water Unit
Grade 6

TIME FRAME	TOPIC	PERFORMANCE TASKS ACTIVITIES/PROJECTS ASSESSMENTS	RESOURCES/INTERDISCIPLINARY CONNECTIONS
September *14 Periods*	Atmosphere	Investigation 1: What is Weather? Part 1: Intro the Weather Part 2: Local Weather *Contribute to local weather data via FOSSweb* *Share digital images with FOSSweb* *Explore Weather Topics, weather lore, and careers in meteorology* **Assessment:** Quick Write, survey Investigation 2: Where's the Air? Part 1: The Air Around Us Part 2: Earth's Atmosphere *Draw atmosphere posters* *Learn about atmospheric research from space* **Assessment:** Scientific Practice, Notebook entry, Inv. 1-2 I-Check Investigation 3: Air Pressure and Wind Part 1: Air Pressure Inquiry Part 2: Pressure Maps *Poem on wind* *Build a wind sock* *Explain drinking straw* *Make airplane observations* *Reduce pressure in a bottle* **Assessment:** Scientific Practice, Response sheet, Inv. 3 I-Check	**Fossweb Resources:** Climate Blog Weather Data Grapher Gas in a Syringe Elevator to Space Pressure Indicator Setup Barometer in a Bottle Weather Balloon Simulation **Additional Resources** Accuweather Air Pressure and Altitude Interactive BrainPOP: Earth's Atmosphere BrainPOP: Weather National Hurricane Weather Center Song: Fresh Air PhET: Gas properties simulation http://www.weather.com/ http://www.wunderground.com/

October *15 Periods*	Energy and Matter	Investigation 4: Convection Part 1: Density of Fluids Part 2: Convection in Water Part 3: Convection in Air *Practicing calculating density* **Assessment:** Scientific Practice, Response sheet, Notebook entry, Inv. 4 I-Check Investigation 5: Heat Transfer Part 1: Latitude Part 2: Solar Angle Part 3: Heating Earth *Simulate heat capacity* *Compare solar energy at two locations* *Share digital images with the FOSS community* **Assessment:** Scientific Practice, Notebook entry, Inv. 5 I-Check	**Fossweb Resources:** Fluid Convection Particles in Solids, Liquids and Gases Convection Chamber Preparation Convection Chamber in Action Convection in Animation Longitude and Latitude Seasons Radiation Animation **Additional Resources** SMART Notebook lesson: Conduction SMART Notebook lesson: Convection
November *7 Periods*	Air Pressure and Wind	Investigation 6: Air Flow Part 1: Conduction Part 2: Local Winds Part 3: Global Winds *Create a 3-D model of wind* *Test conduction through different materials* *Research other atmospheres* *Determine prevailing winds* **Assessment:** Notebook entry, Inv. 6 I-Check	**Fossweb Resources:** Energy Transfer by Collision Conduction Animation Particles in Solids, Liquids and Gases Conduction through Materials Thermometer Local Wind Coriolis on Jupiter **Additional Resources** BrainPOP: Wind

November *14 Periods*	Water	Investigation 7: Water in the Air Part 1: Is Water Really There? Part 2: Phase Change and Energy Transfer Part 3: Clouds and Precipitation *Investigation transpiration* *Review the pressure / temp relationship* *Explore evaporation* *Share digital resources with FOSS community* *Vernier Lab: Relative Humidity* **Assessment:** Scientific Practices, Notebook entry, Response Sheet, Inv. 7 I-Check Investigation 9: The Water Planet Part 1: Water Cycle Simulation Part 2: Ocean Currents Part 3: Ocean Climate *Catch an inflatable globe* *Tackle additional climate factors* *Guest Speaker if available* **Assessment:** Quick write, Scientific Practices, Notebook entry, Response Sheet	**Fossweb Resources:** Cloud in a Bottle Water Cycle **Additional Resources** BrainPOP: Humidity BrainPOP: Water Cycle Harcourt School: Evaporation and Condensation Harcourt School: The Water Cycle
December *6 Periods*	Weather and Climate	Investigation 8: Meteorology Part 1: Weather Balloons Part 2: Weather Maps *Observe a weather balloon launch* *Watch middle school weather balloon video* *Collect local radiosonde data* *Use weather satellite data* *Share digital images with the FOSS community*	**Fossweb Resources:** Weather Balloon Video Weather Balloon Simulation Earth's Climate Over Time C02 in the Ice Core Climate Blog Greenhouse Gas Simulator Human Sources Water Cycle

		Assessment: Quick write, Scientific Practices, Notebook entry, Investigation 8-9 I-Check Investigation 10: Climate Over Time Part 1: Climate Change Part 2: The Role of Carbon Dioxide Part 3: Climate in the News Part 4: Identify Key Ideas *Explore climate regions* *Explore climate change solutions* *Study local climate* *Reflect on remaining questions* *Vernier Lab: The Greenhouse Effect* **Assessment:** Scientific Practices and Posttest	**Additional Resources** BrainPOP: Climate Types BrainPOP: Weather Discovery Education: Weather Patterns and Climate PhET: Greenhouse effect simulation SMART Notebook lesson: Weather and Climate SMART Notebook Lesson: Weather Forecasting Song: Stormin'

UNIT: Waves
Grade 6

ENDURING UNDERSTANDINGS	ESSENTIAL QUESTIONS
✓ Waves have fundamental properties such as wavelength, frequency and amplitude. ✓ The path of light energy can be predicted based on its absorption, reflection, and refraction. ✓ Planning, research, modeling and testing can help engineers develop successful designs. ✓ Modern technology encodes information to improve transmission quality, reliability and speed.	✓ What defines a wave? ✓ Where does light energy go? ✓ How are engineering challenges solved? ✓ How are sound and images sent through radio waves?

NGSS	KNOWLEDGE Students will know:	SKILLS Students will be able to:	CROSS CUTTING CONCEPTS Students will apply:
MS-PS4-1	**Waves** ● A wave is a back-and-forth pattern of motion that transfers energy. ● Key features of waves are crests, troughs, and nodes. ● Waves can be described in terms of wavelength, frequency, and amplitude.	● Monitor their heart rate under different circumstances to think about frequency. ● Create waves using metal springs. ● Use these simple waves to explore the fundamental properties	● Patterns ● Systems and system models ● Energy and matter

	• If you know the frequency and wavelength, you can calculate the velocity of a wave Key Terms: Wave, crest, troughs, nodes, wavelength, frequency, amplitude, velocity	of waves: wavelength, frequency, and amplitude.	
MS-PS4-1 MS-PS4-2 MS-ETS1-1 MS-ETS1-2 MS-ETS1-3 MS-ETS1-4	**Wave Energy** • A mechanical wave travels through a medium. • The amplitude, frequency, and wavelength of a wave are related to the energy transferred by the wave • The frequency and wavelength of a wave are related. • Planning, research, modeling, and testing can help engineers develop successful designs. • A sound wave is a mechanical wave, so it requires a medium to travel. • Waves interacting with media can be absorbed or reflected. Key Terms: Mechanical wave, absorb, reflected, sound wave	• Compare energy in waves with different properties. • Look at an engineering failure and consider the work engineers must do to achieve a successful design. • Develop a chamber that can effectively block sound waves.	• Patterns • Cause and effect • Scale, proportion and quantity • Systems and system models • Energy and matter • Structure and function
MS-PS4-2	**Light Waves** • A wave model can be used to explain the properties of light. • Light travels in straight lines, except at the interface between transparent media where refraction occurs.	• Explore properties of light waves. • Use mirrors to explore reflection. • Use spectroscopes to analyze spectra of visible light and	• Patterns • Cause and effect • Scale, proportion and quantity • System and system models • Energy and matter • Structure and function

	• The angle of incidence equals the angle of reflection. • The electromagnetic spectrum extends beyond visible light. • Different wavelengths of visible light are perceived as different colors. • When light shines on an object, the light is reflected, absorbed, or transmitted through the object. Key Terms: refraction, transparent medium, rainbow, dispersion, absorbed, reflected, transmitted, electromagnetic spectrum	learn more about the electromagnetic spectrum. • Use filters to change the spectrum of a light source and to learn about color. • Determine how refraction changes the path of light rays as they travel between media.	
MS-PS4-2	**Communication Waves** • Light can be transmitted long distances through optical fibers. • Complex information like words, sound, and images must be encoded to be sent as light. • Digital waves can have the same information as analog waves; digital waves can be improved by using smaller increments. • Many modern communication devices use digitized signals (sent as waves) as a reliable way to encode and transmit information. • Modern technology encodes information to improve transmission quality, reliability, and speed. Key Terms: optical fiber, digital waves, analog waves	• Investigate how information can be encoded and sent as digital waves to transfer large amounts of information efficiently over large distances. • Test properties of fiber-optic cables to develop an understanding of how total internal reflection allows data transfer by light. • Investigate how data is encoded and sent as modulated waves to a recipient for demodulation. • Create digital waves and develop an understanding of how digital waves enable modern communications.	• Patterns • Scale, proportion and quantity • Structure and function

Unit: Waves
Grade 6

TIME FRAME	TOPIC	PERFORMANCE TASKS ACTIVITIES/PROJECTS ASSESSMENTS	RESOURCES/INTERDISCIPLINARY CONNECTIONS
January *6 periods*	Waves	Investigation 1: Make Waves Part 1: Pulse Rate Part 2 Spring Waves *Teacher-Led/Guided Activities* *Student project* **Assessment**: Entry-level survey	**Fossweb Resources:** Standing Wave-Video Metronome **Additional Resources** Properties of Waves: Making Waves Visible
February *9 periods*	Wave Energy	Investigation 2: Wave Energy Part 1: Energy in Waves Part 2: Bridge Collapse Part 3: Energy in Sound Waves *Teacher-Led/Guided Activities* *Student project using Google Slides* **Assessment**: Investigations 1-2 I-Check	**Fossweb Resources:** Oscilloscope Big Waves Tacoma Narrows Bridge Collapse 1 Tacoma Narrows Bridge Collapse 2 Soundproof Engineering

			Additional Resources Catching the Wave!
February *9 Periods*	Light Waves	Investigation 3: Light Waves Part 1: Mirrors Part 2: Spectra Part 3: Color Part 4: Refraction *Teacher-Led/Guided Activities* *Student Modeling Project using Google Slides* **Assessment**: Investigation 3 I-Check	**Fossweb Resources:** Refraction **Additional Resources** Harcourt School: The Electromagnetic Spectrum PhET: Color Vision Simulation Song: Roy G Biv The Visible Spectrum Mirrors, Color and Light How Light Travels How We See Things SMART Notebook Lesson: Properties of Light BrainPOP: Light BrainPOP: Rainbows BrainPOP: Refraction and Diffraction Mirrors, Color and Light PhET: Bending Light Simulation Reflection and Refraction Refraction Animation What is a Rainbow?
March 8 Periods	Communicatio n Waves	Investigation 4: Communication Waves Part 1: Optical Fibers Part 2: Sending Sound Part 3: Sending Images *Teacher-Led/Guided Activities* *Student Project*	**Fossweb Resources:** Digitized Images Fiber Optics **Additional Resources** Sound Waves vs. Light Waves "Un-notes" (2 days)

		Assessment: Investigation 4 I-Check	

Unit _Diversity of Life
Grade 6___

ENDURING UNDERSTANDINGS	ESSENTIAL QUESTIONS
✓ All living organisms have specific characteristics in common. ✓ All life is classified among the six major kingdoms. ✓ As a multi-cellular organism grows from a single cell to an adult, cells divide and differentiate.	✓ How do you know if something is a living thing? ✓ How do organisms grow and develop?

NJCCCS	KNOWLEDGE Students will know:	SKILLS Students will be able to:	CROSSCUTTING CONCEPTS Students will apply:
MS-LS1-1	**Life** ● Any free-living thing is an organism. ● All living organisms share seven common traits: they grow, consume nutrients, exchange gases, respond to stimuli, reproduce, need water, eliminate waste, and are composed of cells. Key Terms: living, non-living, organism, grow, nutrient, gas, stimuli, reproduction, waste, dormant, dead	● Develop and apply an operational definition of "living" ● Generate examples and explanations of each of the common traits for living organisms ● Categorize pictures of objects and organisms into living and nonliving groups ● Use evidence and criteria to make claims and arguments about whether a novel object is a living organism ● Apply the characteristics of life to authentic scenarios	Scale, Proportion and quantity
MS-LS1-1 MS-LS1-2 MS-LS3-2	**Cells** ● The cell is the basic unit of life. Most cells are too small to see with the naked eye. ● Microscopes are used to study living things too small for the naked eye to see. The eyepiece and objective lens combine to magnify the image and produce an image that is reversed and inverted.	● Continue to modify and apply an operational definition of "living" ● Use a microscope proficiently to perform observations at appropriate magnifications ● Draw scale representations of images seen in a microscope to estimate size accurately	● Scale. Proportion and quantity ● System and system models

	• Individual cells have the same needs and perform the same functions as more complex organisms. Like we have organs, individual cells have organelles with specific functions. Examples: o Cell membrane o Cell wall o Nucleus o Chloroplast o Ribosome o Mitochondria o Cytoplasm • A major subdivision in cells is whether they have a nucleus (eukaryote) or not (prokaryote). Bacteria and Eubacteria are prokaryotic cells. Most other life forms are made of one or more eukaryotic cells. • Multicellular organisms have specialized cells that work together in tissues, which work together in organs, which work together in organ systems, which work together to meet the needs of the living organism in its environment. • Bacteria, fungi, and archaea demonstrate all the characteristics of life. • Life is classified into three different domains (Archaea, Bacteria, Eukaryote), depending upon cellular and molecular characteristics <u>Key Terms:</u> microorganism, cell, paramecium, organelle, membrane, complex organism, cell wall	• Observe single-celled microorganisms and make inferences about relationships between structure and function • Generate evidence to support the argument that paramecia are organisms • Differentiate between single celled and multicellular organisms • Compare structure and function of cells from different organisms • Identify major organelles in a diagram of eukaryotic cell and relate the function of each to the needs of the living cell • Relate the structure and function of cells, tissues, organs, systems, and organisms • Model the interdependence of the human body's major systems in regulating its internal environment • Look for evidence that bacteria are living organisms and find out more about the role bacteria play on Earth. • Apply understanding of cells to authentic scenarios	

	eukaryotic, prokaryotic, nucleus, chloroplast, ribosome, mitochondria, cytoplasm		
MS-LS1-3 MS-LS1-6 MS-LS1-7	**Transpiration** ● Water is essential to living things. ● Plants use a vascular tissue called xylem to transport water from the roots to the rest of the plant. ● Water continually leaves the plant (transpiration) through the stomata on the underside of leaves in the form of water vapor. Guard cells work to control these opening and regulate the amount of water leaving through the stomata. ● Water in the plant is used with carbon dioxide during photosynthesis to make food (sugar). ● Cells are the building blocks of tissues, which are the building blocks of organs, which are the building blocks of organ systems, which are the building blocks of multicellular organisms Key Terms: transpiration, vascular, xylem, stomata, condensation, water cycle, elodea, guard cell, stomata, photosynthesis	● Continue to modify and apply an operational definition of "living" ● Design an experiment to determine what happens to water in a celery stalk ● Collect and analyze data to develop evidence for an explanation for how water enters a plant's roots and flows through the plant during transpiration ● Relate transpiration to the environmental water cycle ● Explain the importance of water in the plant as an ingredient for photosynthesis to store light energy in sugars ● Apply understanding of transpiration to authentic scenarios	● Scale. Proportion and quantity ● System and system models ● Energy and matter
MS-LS1-3 MS-LS1-4 MS-LS1-5 MS-LS3-2	**Plant Reproduction and Growth** ● Growth is essential to living things.	● Continue to modify and apply an operational definition of "living" ● Dissect seeds to discover their structures ● Relate seed structures to functions	● Cause and Effect ● System and system models

	• Seeds contain the dormant, living embryo of a plant. • Most seeds will stop being dormant and germinate (begin growing) with enough warmth and moisture. • Before seeds develop true leaves to get energy from the sun, the cotyledon is the primary source of food energy for the baby plant. Plants are grouped based on the number of cotyledons they have. Most flowering plants have either one (monocot) or two (dicot). • As seeds grow and develop, cells divide, grow (elongation), and differentiate (maturation) to become specialized cells within a tissue. • Reproduction is essential to living things. • In plants, sexual reproduction is accomplished when pollen from the anthers (male part) and eggs from the ovules (female part) combine to form a new plant embryo (seed). • Seeds are dispersed in a variety of ways to increase the area of a plant population. • Variations exist among plants of the same generation and of different generations. • Plants pass down specific traits such as the color of fruits and flowers to their offspring. This inheritance of traits also takes place in humans (example= eye color) and other organisms. Not all traits are inherited. Some are acquired during our lifetimes. • Environmental and genetic factors affect the germination and growth of plants.	• Investigate the effect of light on germinated seeds through designing and carrying out a controlled experiment, analyzing and communicating data • Investigate how increasing salinity affects the germination and growth of food crops • Compare four grains (corn, wheat, barley, and oats) to determine that the different grains have varying levels of salt tolerance. • Observe and identify cells dividing, growing, and differentiating in an area of plant growth • Relate plant cell structures to functions in the root • Compare the development patterns of different types of plants • Apply understanding of seeds to authentic scenarios • Continue to modify and apply an operational definition of “living” • Dissect flowers to learn about flower structures and sexual reproduction • Identify major structures of a typical plant reproductive organ (flower) • Explain the function of flowers and pollination	

	• Flowering plants have characteristics that attract pollinators to ensure successful pollination and reproduction. • Pollinators are attracted to flowers that meet their needs. • Key Terms: reproduction, sexual reproduction, pollen, anthers, eggs, ovules, embryo, seed, variation, inheritance, acquired, dormant, embryo, dissection, germination, dicot, monocot, cell division, zone of elongation, zone of maturation	• Examine seeds to infer dispersal mechanisms and compare the effectiveness of each in various scenarios • Predict the long-term effect of interference with normal patterns of reproduction • Explain how knowledge of inherited variations within and between generations can be applied to farming and animal breeding • Distinguish between inherited and acquired characteristics • Apply understand of reproduction and inheritance to authentic scenarios	
MS-LS1-3	**Insect Biodiversity** • The structures and behaviors of an organism have functions that enhance the organism's chances to survive and reproduce in its habitat. • Insects have open circulatory systems that transport substances to and away from their cells. • Biodiversity is the variety of life that exists in a particular habitat or ecosystem. • Measuring biodiversity includes measuring both the variety of organisms and the number of organisms in a habitat or ecosystem. • Scientific debate regarding whether viruses are living organisms is ongoing.	• Students observe and record observations of the Madagascar Hissing cockroaches • Use online activities to compare the insect circulatory system to the plant vascular system and the human Cardiovascular (circulatory) System. • Students explore their own locale to collect plants and animals and discover the unexpected diversity of life that exists. • Explore viruses in order to determine	• System and system models

	Key Terms: Madagascar hissing cockroach, insect, habitat, circulatory system, rhinovirus	whether viruses are living organisms.	

Unit Diversity of Life
Grade 6

TIME FRAME	TOPIC	PERFORMANCE TASKS ACTIVITIES/PROJECTS ASSESSMENTS	RESOURCES/INTERDISCIPLINARY CONNECTIONS
March *4 Periods*	Life	Investigation 1: What is Life? Part 1: Living or Non-Living? Part 2: Is anything alive in here? *Search for living/nonliving things outdoors* *Modify the environment* *Research extreme environments* **Assessment :** Survey, quick write, Science and engineering practices, Science notebook entry	**Fossweb Resources:** Camphor Crystals **Additional Resources** *Uncovering Student Ideas in Science* (USIS) Vol. 1, "Is It Living?" pg. 123
April *20 Periods*	Cells	Investigation 2: The Microscope Part 1: Meet the Microscope Part 2: Field of View Part 3: Microscopic Life *Research early microscope and inventors* *Research modern microscopes* *Make a water drop microscope* *View other objects through the microscope* **Assessment :** Science notebook entry, response sheet, Science and engineering practices Investigation 3: The Cell	**Fossweb Resources:** Lab Techniques :Moving the Microscope Lab Techniques: Making a Wet Mount Virtual Microscope Microscope Measurements Lab Techniques: Making a Brine Shrimp Slide Database: Brine Shrimp Eating Database: Brine Shrimp Database: Elodea Cytoplasmic Streaming Plant Cell Elodea Cells Lab Techniques: Preparing a Paramecia Wet-Mount Slide

		Part 1: Discovering Cells Part 2: Paramecia Part 3: Micro-worlds Part 4: Human Cheek Tissue *Look at other protists* *Check soil for life* *Feed paramecia* *Model Paramecium feeding* **Assessment :** Response sheet, Science and engineering practices, Investigation 1-3 I Check Investigation 4: Domains Part 1: Comparing Living Things Part 2: Bacteria Part 3:Fungi Part 4: Archaea *Make a wanted poster* *Research taste* *Research interesting Fungi* *Research food and microorganisms* **Assessment :** Response sheet, Science and engineering practices, quick write, science notebook entry, Investigation 4 I-Check	Lab Technique: Using Cotton to Slow Paramecia Database: Paramecium Protist Cell Database: Microorganism Collection Lab Technique: Making a Human Cheek Tissue Slide Database: Human Cheek Cells Animal Cell Lab Techniques: Preparing an Agar Plate Lab Technique: Inoculating an Agar Plate Levels of Complexity Card Sort The Scale of the Universe Database: Yogurt Bacteria Bacteria Cell A Million Dollars Exponential Bacteria Fungal Cell Funky Fungi Freak Show Itsy Bitsy Thingy Locator Archaean Cell **Additional Resources** BrainPOP: Cells BrainPOP: Microscopes BrainPOP: Protists BrainPOP: Protozoa Harcourt School: Cell Inspector Harcourt School: Comparing Plant and Animal Cells Harcourt School: Mitosis Harcourt School: Protists SMART Notebook lesson: Cells Song: Cells

			USIS Vol. 1, “Functions of Living Things” pg. 147 USIS Vol. 1, “Is It Made of Cells?” Pg. 131 USIS Vol. 3, “Cells and Size” pg. 117
April *6 Periods*	Transpiration	Investigation 5: Plants the Vascular System Part 1: What Happened to the Water? Part 2: Looking at Plant Structures Part 3: Transpiration and Photosynthesis *Calculate total transpiration* *Investigate celery further* *Look for stomata on elodea leaf* **Assessment :** Science notebook entry, response sheet, Science and engineering practices, quick write, Investigation 5 I-Check	**Fossweb Resources:** Database: Stomata Collection Database: Stem Collection Vascular System **Additional Resources** Harcourt School: Vascular Plants
May *8 Periods*	Plant Reproduction and Growth	Investigation 6: Plant Reproduction and Growth Part 1: Lima Bean Dissection Part 2: Environmental and Genetic Factors Part 3: Flowering Plant Reproduction Part 4: Flowers and Pollinators *Look for flowers* *Look for pollinators* *Share digital images with the FOSS community* *Research honeybees* *Plant bee-friendly flowers* *Guest speaker if available* *Think further about seeds* *Plant collected seeds*	**Fossweb Resources:** Database: Seed Collection Lab Technique: Preparing the Flower Dissection Mount Database: Flower Collection Database: Pollinator Collection Pollinators Game **Additional Resources** BrainPOP: Seed Plants USIS Vol.2, “Needs of Seeds” pg. 101 USIS Vol.2, “Plants in the Dark and Light” pg. 107 BrainPOP: Pollination Harcourt School: Inside a Flower Harcourt School: Types of Fruit SMART Notebook lesson: Main Flower Parts

		Assessment : Science notebook entry, response sheet, Science and engineering practices, science notebook entry, Investigation 6 I-Check	
May *4 Periods*	Insects	Investigation 7: Insects Part 1: Structure, Function, and Behavior Part 2: Insect Systems *Investigate insect lifestyles* *Research endangered insect species* *Talk with an entomologist* *Explore bizarre insect behaviors* **Assessment:** Science and engineering practices, Science notebook entry, group response	**Fossweb Resources:** Database: Insect Collection Levels of Complexity **Additional Resources** BrainPOP: Insects
May June *4 blocks*	Diversity	Investigation 8: Diversity of Life Part 1: Bioblitz Part 2: What is Life? *Conduct a neighborhood bioblitz* *Look into an official bioblitz* *Try some OBIS activities* *Watch some bioblitz videos from other sites* *Do the bioblitz bird dance* *Research viral diseases* **Assessment:** Science and engineering practices, science notebook entry, posttest	**Fossweb Resources:** Flu Attack Viruses on Attack **Additional Resources** BrainPOP: Bacteria BrainPOP: Six Kingdoms Song: Jennifer's a Mammal Song: Mammal The Six Kingdoms

Science

Grade 7

UNIT: Planetary Science
Grade 7

ENDURING UNDERSTANDINGS	ESSENTIAL QUESTIONS
✓ Observable, predictable patterns of movements in the Sun, Earth, and Moon system occur because of gravitational interaction and energy from the Sun. ✓ Climate is determined by the Earth's rotation and revolution as well as processes on the Earth.	✓ What patterns can we observe and predict because of the Earth, Sun, and Moon?

NGSS	KNOWLEDGE Students will know:	SKILLS Students will be able to:	CROSS CUTTING CONCEPTS Students will apply:
MS-ESS1-1	**Point of View on Earth**	● Use web-based images to observe and describe where they are as their point of view moves away from Earth's surface in powers of ten.	● Scale, Proportion and Quantity ● Patterns

	• 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. • Key Terms :Location, Point of view, altitude, elevation, frame of reference	• Observe the shape, tilt, color, size, and location of the Moon • Create a Moon log to chart daily changes in the Moon's appearance.	
MS-ESS1-1	**Day and Night** • 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). • Earth rotates counter-clockwise every 24 hours, causing day and night. The side of the Earth facing towards the sun experiences day while the other side experiences night. • Earth's axis tilts at an angle of 23.5° and points toward the North Star.	• Generate evidence that Earth is a sphere • Develop a rational argument for a spherical Earth. • Use models to relate Earth's motions to the Sun • Communicate how to determine the direction of Earth's rotation • Apply understanding of the Earth/Sun relationship to authentic scenarios	• Patterns • System and system models • Cause and effect

	Key Terms: horizon, line of sight, axis, rotation, day, night		
MS-ESS1-1	**Seasons** ● Because the Earth rotates on an axis that is tilted relative to the plane of the Earth's yearly revolution around the sun, sunlight falls more intensely on different parts of the Earth during the year; the difference in heating of the Earth's surface produces the planet's seasons and weather patterns. ● The lower the angle at which light strikes a surface, the lower the density of the light energy. ● Beam spreading affects the intensity of solar radiation on Earth's surface ● 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. Key Terms: tilt, axis, rotation, revolution, seasons, direct sunlight, indirect sunlight	● Use models to relate Earth's motions to the Sun ● Use evidence of global variations in day length, temperature/seasons, and the amount of solar radiation striking Earth's surface to create models that explain these phenomena ● Create and interpret diagrams to predict and explain seasonal temperature changes ● Read an account of day length around the planet and graph the duration of daylight throughout the year ● Apply understanding of the Earth/Sun relationship to authentic scenarios	● Scale, proportion and quantity ● System and system models ● Patterns ● Cause and effect
MS-ESS1-1 MS-ESS1-3 MS-ESS3-2	**Moon Phases and Features**	● Generate a set of questions about the Moon, organize them into categories,	● Scale, proportion and quantity ● System and system models ● Patterns

	• The Moon has surface features that can be identified in telescope images: craters, Maria, and mountains. • The Moon revolves around Earth and rotates on its axis in about 28 days. • The Moon's orbit changes what part of the moon is lighted by the sun and how much of that part can be seen from Earth. We can predict this pattern and call this the phases of the Moon. • The Moon goes through phases: "new" to "full" and back to "new" in a 4-week cycle. • Craters of various sizes and types result when meteoroids of various sizes impact the surface of planets and satellites. • The Moon formed after a massive collision between the forming Earth and a planetesimal about the size of Mars. • 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. Key Terms: rotate, revolve, phase, moon phases (new, first quarter, full,, third quarter, waxing, waning, crescent, gibbous) craters, solar system	and use them to guide their continued inquiry. • Explore the Earth/Moon relationship by creating a scaled model of the system • Analyze moon-phase data to construct models that explain how the relative positions and motions of the Sun, Earth, and Moon cause these phenomena • Explain the roles of rotation and revolution of the Earth and the Moon in the presentation of phases • Predict relative positions of the Sun, Earth, and Moon when shown a representation of a Moon phase • Design experiments to investigate different variables and determine if impact events could be responsible for the extensive cratering on the Moon's surface. • Generate drawings depicting all the objects in the solar system. • Choose and defend theories related to Moon's origin • Apply understanding of the Earth/Moon relationship to authentic scenarios	• Cause and effect
MS-ESS1-2 MS-ESS1-3	**Cosmo Exploration**	• Create model of the inner solar system	• Scale, proportion and quantity • System and system models

MS-ESS2-2 MS-PS4-1	• 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 planet's mediating atmosphere. • Images can convey information about the presence and history of liquid water on planetary surfaces. • 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 composition and environmental conditions on the planets, moons, and other bodies in the solar system. • Planetary-system objects move in measurable and predictable patterns. • A transit occurs when a planet passes 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	• Use actual atmospheric data and temperature data to look for a relationship between atmosphere and temperature. • Study satellite images of typical water-related landforms on Earth and space. • Use a spectroscope to observe the radiant spectra of a number of light sources, including the Sun, fluorescent lamps, and incandescent lamps • Use an orrery and light sensor, they generate transit graphs and analyze them to draw conclusions about unknown planets • Review what they have learned in the course and restate their cosmic address	• Patterns • Cause and effect

	Key Terms: spectroscope Gravity, gravitational pull, mass, distance, proportion		

Planetary Science Unit
Grade 7

TIME FRAME	TOPIC	PERFORMANCE TASKS ACTIVITIES/PROJECTS ASSESSMENTS	RESOURCES/INTERDISCIPLINARY CONNECTIONS

September *3 periods*	Point of View on Earth	Investigation 1: Where am I Part 1: School to Space Part 2: Moon Watch *Strengthen vocabulary* *Power of Ten Video* *Apply Math to a map* *Compare photos to maps* *Examine maps in everyday use* *Explore images on the internet* **Assessment:** Survey, response sheet, science practices	**Fossweb Resources:** White house views **Additional Resources** Google Earth
September *4 periods*	Day and Night	Investigation 2: A Round Spinning Earth Part 1: Sailing Ships Part 2: Earth/Sun Relationship *Round Earth/Flat Earth* *Recreate Eratosthenes's discovery* *Prove Earth is round* *Share digital images with the Foss community* **Assessment:** Response sheet, Scientific practices, quick write, investigations1-2 I-check	**Fossweb Resources:** Astra Blog Latitude and Longitude Earth Models Round Earth /Flat Earth Libertad Day and Night Simulation **Additional Resources** Harcourt School: Shadows Throughout the Day
October *7 periods*	Seasons	Investigation 3: Seasons Part 1: Summer Heat Part 2: Day Length *Research and Modeling of Seasons* *Reason for the Seasons Web quest* *Calculate local noon* *Research Time Zones* *Locate East- West*	**Fossweb Resources:** Seasons Latitude and Longitude **Additional Resources** BrainPOP: Seasons Vernier Lab: What Causes the Seasons?

		Measure beam spreading *Compare cities* *Change Earth's tilt* *Investigate day length and sunset* *Investigate seasons in the Southern Hemisphere* **Assessment:** Response sheet, quick write, Investigations1-3 I-check	
October *16 periods*	Moon Phases and Features	Moon Investigation 4: Moon Study Part 1: A Close Look at the Moon Part 2: How Big/ How Far? *Share digital images with FOSS Community* *Calculate travel time* *Design additional models* *Explore the Moon online* **Assessment:** Scientific practices Investigation 5: Phases of the Moon Part 1: Observed Patterns Part 2: Moon- Phase Models Part 3: Moon Phase Simulation *Investigate moon rotation* **Assessment:** Response sheet, Scientific practices, quick write, Investigations 4-5 I-check Investigation 6: Craters Part 1: Moon Craters Part 2: Target Earth Part 3: Moon Phase Simulation *Scale craters to a local map* *View " Earth Craters"* *View NASA crater experiments* **Assessment**: Scientific practices, Investigations 6 I-Check	**Fossweb Resources:** Rona/Moon Animation Moon Orientation Lunar Calendar Day/Night Moon Puzzle Phases of the Moon Crater formation on the Moon Model Craters Crater formation on the moon Space Units Cosmos card sort Solar system origin card sort Origin of the moon Tides Space missions Jupiter's atmosphere Search for water Solar System Properties of Light Comparing Spectra Space Missions Astro Blog

		Investigation 7: Beyond the Moon Part 1: What's Out There Part 2: Origins *Simulate solar system formation* **Assessment**: Quick draw Investigation 8: The Solar System Part 1: Where are the Planets Part 2: Comparing Temperature and Atmosphere Part 3: Where is the Water? *Construct another model of the solar system* *Explore planets with Hands -On Universe* **Assessment**: Scientific practices, science notebook entry, Investigations 7-8 I-Check Investigation 9: Space Exploration Part 1: Light Spectra Part 2: Exploration of the Solar Systems *Research NASA on the internet* *Learn more about the electromagnetic spectrum* *Review human space exploration with a time line* **Assessment**: Scientific practices, Investigations 9 I-Check Investigation 10: Orbits and New Worlds Part 1: Moons of Jupiter Part 2: Looking for Planets Part 3: What is our Cosmic Address *Study actual transit curves* **Assessment**: Science notebook entry, Scientific practices, Posttest	Moons of Jupiter Collection Exoplanet Transit Hunt Orrery Video 1 Orrery Video 2 Venus Transit For All Mankind: DVD Asteroids: Deadly impact Hubble's Amazing Universe DVD **Additional Resources** BrainPOP: Moon SMART Notebook lesson: Phases of the Moon SMART Notebook lesson: BrainPOP: Gravity Harcourt School: How Planets Move in Orbits Harcourt School: The Gravity of the Situation PhET: Gravity and Orbits Simulation Song: G-R-A-V-I-T-Y Your Weight on Other Worlds STAR-LAB Lessons (If available)

UNIT: Electromagnetic Force
Grade 7

ENDURING UNDERSTANDINGS	ESSENTIAL QUESTIONS
✓ A force is a push or pull ✓ Friction is a force that acts to oppose a force acting to put a mass in motion	✓ What makes things move? ✓ How does friction affect the force needed to move an object? ✓ How do multiple forces affect motion?

NGSS	KNOWLEDGE Students will know:	SKILLS Students will be able to:	**CROSS CUTTING CONCEPTS** **Students will apply:**
MS-PS2-2	**Forces** ● Forces are a push or a pull; two objects don't necessarily need to be touching to push or pull on one another. ● The metric unit for force is newton ● Friction is a force that acts to oppose a force acting to put a mass in motion ● Net force is the sum of the forces acting on a mass.	● Plan and carry out investigations to measure the force requires to push and pull various objects on various surfaces ● Analyze and interpret data from force experimentation to draw conclusions about force and friction ● Use mathematics and computational thinking when analyzing data about friction and net force	● Patterns ● Cause and Effect ● Systems and System Models ● Stability and Change

	Key Terms: Energy, force, friction, interaction. , kinetic energy, Newton, spring scale, net force	• Apply understanding of forces to authentic scenarios	
MS-PS2-2 MS-PS2-3 MS-PS2-5 MS-PS3-2 MS-PS2-4 MS-PS3-2	**Magnetism** • Magnets stick to attract objects that contain iron • All magnets have two poles, a north pole on one side and a south pole on the other side. • Like poles of magnets repel each other, opposite poles attract • Magnets are surrounded by an invisible magnetic field, which acts through space and through all nonmagnetic materials. • Magnetic materials may become temporary magnets when they interact with magnetic fields • The magnitude of the magnetic force between two interacting magnetic fields decrease as the distance between them increases. Key Terms: Attract, compass, gravitational force, induced magnetism, magnet, magnetic field, magnetism, permanent magnet, pole, potential energy, repel, temporary magnet	• Analyze and interpret data about magnetic force in a series of experiments looking at force over distance and force when more magnets are introduced. • Formulate questions that arise from examining given data of objects interacting through magnetic forces. • Determine cause and effect relationships that affect magnetic forces • Predict the strength of magnetic forces due to cause and effect relationships • Develop and use models to construct explanations about magnetic fields and explain their properties and interactions. .	• Patterns • Cause and Effect • System and System Models • Energy and matter

MS-PS2-2 MS-PS2-3 MS-PS2-5 MS-PS3-2 MS-ETS1-1 MS-ETS1-2 MS-ETS1-3 MS-ETS1-4	**Electromagnetism** ● An electric circuit is a system that includes a complete pathway through which electric current flows. ● A magnetic field surrounds a wire through which electric current is flowing ● The magnetic field produced by a current carrying wire can induce magnetism in a piece of iron or steel ● An electromagnet is made by sending electric current through an insulated wire wrapped around an iron core ● The strength of magnetism induced in the core of an electromagnet increases with the number of winds of wire, the amount of electric current flowing in the wire, and the iron content of the core. Key Terms: Battery, circuit, component, constraint, contact point, core, criterion, electric current, electromagnet force, electromagnetic radiation, electromagnetism, energy transfer, engineer, filament, insulation	● Develop and use a model to explain how a magnetic field results from an electric current through a wire ● Design an electromagnet that will meet specific criteria and constraints	● Patterns ● Cause and Effect ● System and System Models ● Structure and function ● Energy and Matter
MS-PS3-5 MS-ESS3-3 MS-ESS3-4	**Energy Transfer**	● Analyze and interpreting data to compare the components and function of motors and generators ● Develop and use models to explain energy transfers within a system	● Cause and effect ● System and System Models ● Scale proportion and Quantity ● Energy and Matter ● Structure and function

	● An electric motor is designed with a commutator that acts as a switch, turning on and off an electromagnet ● Electric generators transfer energy from kinetic energy to electrical energy ● Energy cannot be created or destroyed, only transferred ● Every energy use can be described as a sequence of energy ● Energy sources can be categorized as renewable or nonrenewable <u>Key Terms:</u> Brush, commutator, fossil fuel, generator, motor, nonrenewable, rotate, shaft, solar cell	● Obtain, evaluate and communicate information about energy sources for human use, including renewable and nonrenewable sources, and their environmental consequences.	● Stability and change

<u>Electromagnetic Force</u>
Grade 7

TIME FRAME	TOPIC	PERFORMANCE TASKS ACTIVITIES/PROJECTS ASSESSMENTS	RESOURCES/INTERDISCIPLINARY CONNECTIONS

November-December ***6 sessions***	**Forces**	Investigation 1: What is force? Part 1 Push and pull Part 2: Friction Part 3: Forces in action *Develop force problems, test force in online simulations* Assessments: Survey, Science and engineering practices, performance assessment, response sheet, Inv 1 I-Check	**Fossweb Resources:** What is a Force Forces Force and Motion Basics PHET **Additional Resources** Motion and Stability: Forces and Interactions BrainPOP: Force Harcourt School: Which Direction? SMART Notebook Lesson: Friction Force SMART Notebook Lesson: Push and Pull Song: Friction Happens
December ***7 sessions***	**Magnetism**	Investigation 2: The force of magnetism Part 1 Properties of magnets Part 2: Magnetic Fields Part 3: Force over distance *Make a compass, draw actual magnetic field, investigate polarity of metal objects, conduct more force investigations* Assessment: Response sheet, , Science and engineering practices, performance assessment, Inv 2 I-Check	**Fossweb Resources:** The Force of Magnetism Adding magnetic fields Magnetism **Additional Resources** Web quest- Magnets and Static Electricity Discovery Education: Magnets How Stuff Works: Magnets

January ***8 Sessions***	**Electromagnetism**	Investigation 3: Electromagnetism Part 1 Building a circuit Part 2: Building an electromagnetic Part 3: Improving the design *Make a rheostat, build the ultimate electromagnet* Assessment: Response sheet, , Science and engineering practices, performance assessment, Inv 3 I-Check	**Fossweb Resources:** Electromagnetism Lighting a bulb Kitchen Magnets Virtual Electromagnet **Additional Resources**
February **6 Sessions**	**Energy Transfer**	Investigation 4: Energy Transfer Part 1 Electric Motors Part 2: Electric Generators Part 3: Force and Energy *Dissect electronics, Research Brushless motors.* Assessment: Science notebook entry, performance assessment, Post test	**Fossweb Resources:** Transfer of energy Kitchen Magnets Generator Dissection **Additional Resources**

UNIT Gravity and Kinetic Energy
Grade 7

ENDURING UNDERSTANDINGS	ESSENTIAL QUESTIONS
✓ Gravity is an attractive force between two objects ✓ An object in motion stays in motion unless acted on by an extrenal force ✓ For every action there is an equal and opposite reaction	✓ How does gravity cause objects to move? ✓ What happens to an object's energy when it moves faster? ✓ What happens when moving objects collide? ✓ How can humans protect themselves in collisions?

NGSS	KNOWLEDGE Students will know:	SKILLS Students will be able to:	**CROSS CUTTING CONCEPTS** **Students will apply:**

MS-PS2-2 (foundational) MS-PS2-4 (foundational)	**Acceleration** ● The average speed of an object is the distance it travles in a unit of time ● The slope of the line on a graph of distance versus time represents the speed, steeper slopes represent faster speeds ● An object that does not move at a constant speed has acceleration, change of speed per unit time ● A falling objective increases speed with a constant acceleration, regardless of the object's mass. ● Gravity is an attractive force between two objects with a rate of acceleration of 9.8 m/s2 on earth Key Terms: Accerleration, air resistance, ave speed, constant speed, distance, force, gravity, position, slope, speed	● Analyze line slope to make claims about an object's speed ● Construct and analyze data sets to identify patterns and distinguish between speed and acceleration ● Use digital tools to analyze motion video data and determine the force of gravity on earth ● Apply understanding of acceleration to authentic scenarios	● Patterns ● Scale, proportion, and quantity ● Systems and System Models ● Structure and function
MS-PS2-2 MS-PS2-4 MS-PS2-5 (Foundational) MS-ESS1-2 (Foundational)	**Gravity** ● Gravity is an attractive force between two objects ● Mass is the amount of matter in an object. ● The acceleration of an object increases if the force acting upon it increases ● If identical force is applied to two objects with different masses, the more massive object will accelerate less that the less massive object	● Calculate weights at locatoins with different gravitational forces ● Analyze data to construct explanations about proportional relationships between mass, force and acceleration ● Apply force of gravity to authentic situations	● Patterns ● Cause and Effect ● System and System Models ● Scale, proportion and quantity

	Key Terms: Gram, mass, newton, weight		
MS-PS2-1 MS-PS2-2 MS-PS3-1 MS-PS3-5	**COLLISIONS** ● Kinetic energy is energy of moving things, potential energy is energy dependent on the position of the object ● A collision transfers kinetic energy ● Increasing the mass of an object by some factor increases its kinetic energy by the same factor; increasing the speed of an object by some factor increases its kinetic energy by the same factor squared ● An object in motion will stay in motion with the same speed unless acted on by an extrenal force ● For every action there is an equal and opposite reaction Key Terms: collisions, energy, friction,joule, kinetic energy, potential energy, variable	● Collect and analyze data from collisions to determine the relationships between speed, mass, and kinetic energy	● Patterns ● Cause and Effect ● System and System Models ● Scale proportion and quantity ● Energy and Matter ● Stability and change
MS-PS2-1 MS-PS3-5 MS-ETS1-1 MS-ETS1-2 MS-ETS1-3 MS-ETS1-4	**Engineering Task** ● Impulse is force applied over a period of time ● Extending the time of a collision, by slowing an object's deceleration, results in less force on the object	● Define an engineering problem and design solutions through an iterative process ● Engage in argument from evidence to evaluate solutions to a design challenge	● Patterns ● Scale proportion and Quantity ● Energy and Matter ● Cause and effect

	● Safety features to protect humans in collisions use properties of physics to slow deceleration ● Engineers use an iterative process to solve problems <u>Key Terms:</u> Constraint, criterion, impulse	● Develop and use a model to describe the iterative process of engineering design ● Construct explanations and ask questions about physics concepts related to kinetic energy, gravity and collisions	

<u>Gravity and Kinetic Energy</u>
Grade 7

TIME FRAME	TOPIC	PERFORMANCE TASKS ACTIVITIES/PROJECTS ASSESSMENTS	RESOURCES/INTERDISCIPLINARY CONNECTIONS

November-December ***6 sessions***	**Acceleration**	Investigation 1:Acceleration Part 1: Speed Track Part 2: Acceleration Track Part 3: Acceleration of Gravity *Calculate race acceleration* Assessments: Survey, Science and engineering practices, performance assessment, Inv 1 I-Check	**Fossweb Resources:** Falling Ball Analysis slide show Movie Tracker Movie Tracker Data Falling Ball Hammer and Feather in Space Heavy and Ligh Balls **Additional Resources**
December ***7 sessions***	**Gravity**	Investigation 2: The force of gravity Part 1: Mass and Weight Part 2: How Heavy *Illustrate different gravitational force, calculate weight on other planets* Assessment: Performance assessment, Inv 2 I-Check	**Additional Resources**

January ***8 Sessions***	**Collisions**	Investigation 3: Energy and Collisions Part 1 Potential and Kinetic Energy Part 2: Stop or Crash Part 3: Marble Collision *Write about netwon's laws* Assessment: Science notebook entry, performance assessment, Inv 3 I-Check	**Fossweb Resources:** **Additional Resources**
February **6 Sessions**	**Engineering Task**	Investigation 4: Collision Engineering Part 1 Helmey Design Part 2: Big Idea *Research self driving cars, Tets water ballons* Assessment: performance assessment, Post test	**Fossweb Resources:** Understanding Car Crashes Basic Physics **Additional Resources**

UNIT: Populations and Ecosystems
Grade 7

ENDURING UNDERSTANDINGS	ESSENTIAL QUESTIONS
✓ Living organisms convert the sun's energy into stored energy to be used within the organism or passed through the ecosystem. ✓ Evolution provides a scientific explanation for the diversity of organisms found on the earth due to descent with modification from common ancestors. ✓ Natural selection is the driving force for evolution. ✓ There are predictable patterns of inheritance.	✓ Where does energy go? ✓ How does evolution happen? ✓ How is genetic information passed through generations?

NGSS	KNOWLEDGE Students will know:	SKILLS Students will be able to:	CROSS CUTTING CONCEPTS
MS-LS2-1 MS-LS2-2 MS-LS2-3	**Food Webs** ● An organism's habitat is where it lives—the place where it can meet all of its requirements for life ● Biotic factors are living factors in an ecosystem; abiotic factors are nonliving factors. ● The Mono Lake ecosystem is defined by the interactions among the organisms and abiotic factors that exist in the Mono Lake basin	● Record observations of organisms interacting within an ecosystem ● Predict interactions of organisms with each other and the abiotic environment ● Use data to create a food web illustrating feeding relationships in an ecosystem ● Interpret a food web to determine feeding relationships in an ecosystem	● Patterns ● System and system models ● Scale, proportion and quantity ● Cause and effect ● Energy and matter ● Stability and change ● Influence of Science, Engineering, and Technology on Society and the Natural World

	● Food is energy-rich organic matter that organisms need for life. ● All the feeding relationships in an ecosystem define the food web for that system. ● Feeding relationships define trophic levels: producers, consumers, and decomposers. ● The most general distinction between plants and animals is that plants use sunlight to make their own food, and animals consume either plants or other animals to obtain energy. ● Symbiotic relationships are interactions between two species. The food web includes producer/consumer, decomposer/prey, predator/prey, and scavenger/prey. Another symbiotic relationship is parasite/host in which one organism draws energy from another while it continues to live. <u>Key Terms:</u> organism, habitat, species, producers, consumers, decomposers, trophic levels, energy, symbiosis, predator, prey, parasite, host, species, population, community, ecosystem, biotic, abiotic	● Analyze the components of a consumer's diet and trace them back to plants and plant products ● Classify symbiotic relationships in authentic scenarios ● Apply understanding of food webs to authentic scenarios	

MS-LS2-1 MS-LS2-2 MS-LS2-3 MS-LS1-6 MS-LS1-7	**Energy Relationships** ● Almost all food contains energy that comes originally from sunlight ● Between trophic levels in a food web, only 10% of energy is transferred from one level to the next ● Decomposers recycle food molecules to basic particles for use by organisms in the ecosystem. ● Food provides molecules that serve as fuel and building materials for all organisms. ● Energy transferred from food is measured in kilocalories. ● For the body to use energy and building materials, the food must be digested into molecules that are absorbed and transported to cells. ● Energy can change from one form to another in living things. ● In photosynthesis, plants use the energy in light to make sugars (in which it is stored as chemical potential energy) out of H_2O and CO_2 ● Photosynthesis produces potential energy and aerobic cellular respiration transfers usable energy to organisms. Key Terms: photosynthesis, chemical potential energy, cells, kilocalories	● Monitor and compare seed growth to determine the role of light in biomass production. ● Use data to create a food web illustrating energy relationships in an ecosystem ● Interpret a food web to determine energy relationships in an ecosystem ● State and interpret the photosynthesis equation ● Analyze the components of a consumer's diet and trace them back to plants and plant products ● Model to investigate energy transfer in food discussing limitations of the model ● Investigate and measure the amount of energy from a food source ● Determine the mass production needed to support primary, secondary, and tertiary consumers using the 10% rule of energy transfer ● Apply understanding of energy relationships to authentic scenarios	● System and system models ● Cause and effect ● Energy and matter ● Stability and change

MS-LS2-1 MS-LS2-2 MS-LS2-4	**Populations Changing Over Time** ● Reproductive potential is the theoretical unlimited growth of a population over time. ● A limiting factor is any biotic or abiotic component of the ecosystem that controls the size of a population ● Both lab experimentation and field observation contribute to the study of populations. ● Biotic and abiotic factors can limit population size ● All organisms, including the human species, are part of and depend on two main interconnected global food webs: one includes microscopic ocean plants, the animals that feed on them, and the animals that feed on those animals; the other web includes land plants, the animals that feed on them, and so on. ● Changes in environmental conditions can affect the survival of individual organisms and entire populations of species. Organisms with traits favorable to new environments thrive, while others may go extinct if they are not equipped to survive in the new environment. Key Terms: limiting factors, populations, extinction, biotic, abiotic	● Calculate the theoretical growth of a population with no limits ● Use a computer simulation to learn about population limiting factors, and analyze the results of a laboratory study ● Analyze data on the effects of abiotic factors on populations ● Relate abiotic and biotic factors to the growth or decline of populations ● Describe how a population can change over time in response to environmental factors ● Organize and present evidence to show how the extinction of a species is related to an inability to adapt to changing environmental conditions using quantitative and qualitative data ● Apply understanding of change over time to authentic scenarios	● Cause and Effect ● Energy and matter ● System and system models ● Stability and change

MS-LS2-4 MS-LS2-5 MS-ESS3-3 MS-ESS3-4 MS-ETS1-1 MS-ETS1-2	**Human Impact on Ecosystems** ● A biodiversity index is one measure of the ability of an ecosystem to deal with stress. In a sustainable ecosystem, the system is resilient to change. ● Introduced species compete with native species in an ecosystem. ● If an introduced species has no predators in the new ecosystem, it can thrive and become invasive. ● Humans affect ecosystems in both positive and negative ways ● Humans rely on ecosystems for ecosystem services (provisioning, regulating, cultural, and supporting services). ● Changes in ecosystems can affect services essential to humans. ● Solutions can be engineered to mitigate human impact. Key Terms: Biodiversity index, native species, invasive, human impact	● Conduct biodiversity study of schoolyard to determine the health of the schoolyard ecosystem. ● Consider the effect of introduced species on native species and identify invasive species. ● Become familiar with a major problem facing the ecoscenario due to human impact, and explore how it was caused. ● Consider aspects of both ecology and engineering to select a solution that helps balance the health of the ecosystem and the needs of humans that depend on the ecosystem ● presents the information	● Cause and Effect ● Energy and matter ● System and system models ● Stability and change

Unit Populations and Ecosystems
Grade 7

TIME FRAME	TOPIC	PERFORMANCE TASKS ACTIVITIES/PROJECTS ASSESSMENTS	RESOURCES/INTERDISCIPLINARY CONNECTIONS

March- April *20 Periods*	Food Webs	Investigation 1: Milkweed Bugs Part 1 Introducing Milkweed Bugs Part 2: Milkweed bug Habitat Part 3: Observing Milkweed Bugs *Maintain a milkweed-bug colony* **Assessments:** Survey, Science and engineering practices, Science notebook entry Investigation 2: Sorting Out Life Part 1 Ecosystem Card Sort Part 2: Video Population Study Part 3: Ecoscenarios *Learn about your biome* *Go local with Roots & Shoots!* *Create a local ecoscenario (Part 1)* *Learn more about the other two of the "primates"* *Share digital images with the FOSS community* Jane Goodall Research **Assessments:** Science and engineering practices Investigation 3: Mono Lake Part 1: A Visit to Mono Lake Part 2: Mono Lake Food Web Part 3: Ecoscenarios Food Web *Create a local ecosenario (Part2)* *Share digital images with FOSS community* **Assessment:** Science Book entry Investigation 4: Mini-habitats Part 1: Introducing Life Part 2: Observing Mini-habitats *Localize your mini-habitats*	**Fossweb Resources:** The Mono Lake Story Organism Database

		Observe the effects of a decomposer *Study a local watershed* *Share digital images with the FOSS community* **Assessments:** Teacher Generated, Science Notebook	
April *15 Periods*	Energy Relationships	Investigation 5: Producers Part 1: Growing Producers Part 2: Biomass and Producers Part 3: Ecoscenario Producers Part 4: Energy Transfer from Food *Outdoor research: local plant survey* *Participate in citizen science: Project Budburst* **Assessments:** Investigations 4-5 I-Check Investigation 6: Following the Energy Part 1: Using Energy Part 2: Food Chain Game Part 3: Trophic Levels Part 4: Decomposers *Diagram humans in food webs* *Describe human trophic levels* *Consider human in food webs* *Share digital images with the FOSS community* **Assessments: Investigations 6 I-Check**	**Fossweb Resources:** Ecoregions Ecoscenarios Biomes **Additional Resources** Harcourt School: Energy Pyramid Song: Photosynthesis BrainPOP: Food Chains Harcourt School: Fun with Food Webs Song: It's the Food Web
May *8 Periods*	Populations Changing Over Time	Investigation 7: Population Size: Reproductive Potential Part 2: Limiting Factor Part 3: Population Dynamics *Discuss other population limitations* *Study population dynamics in ecoscenarios*	**Fossweb Resources:** Milkweed Bugs Unlimited Milkweed Bugs Limited **Additional Resources** BrainPOP: Population Growth

		Simulate winter survival **Assessments:** Investigation 7 I-Check	
May June *14 Periods*	Human Impact on Ecosystem	Investigation 8: Human Impact Part 1: Biodiversity Part 2: Invasive Species Part 3: Mono Lake Revisited *Find out National Geographic bioblitz* *Learn about seafood choices* *Share digital images with the FOSS community* *Create a wildlife habitat at school* *Explore schoolyard biodiversity resources* *Create missing and wanted posters* **Assessments:** Investigations 8 I-Check Investigation 9: Ecoscenarios Part 1: Human Involvement Part 2: Evaluating Solutions Part 3: Presentations *Extending the Investigation* *Create a local ecoscenario (Part 4): local issues* **Assessment:** Posttest	**Fossweb Resources:** Ecoscenario Research Center

Science

Grade 8

UNIT: Chemical Interactions
Grade 8

ENDURING UNDERSTANDINGS	ESSENTIAL QUESTIONS

✓ Everything is made up of matter. ✓ The structure of matter is affected by energy. ✓ Substances are made up of particles with different properties that interact in different ways. ✓ Matter can be changed, but cannot be created or destroyed.	✓ What is matter and how does it behave? ✓ How does energy affect matter? ✓ What makes one substance different than another? ✓ Where does matter go?

NGSS	**KNOWLEDGE** **Students will know:**	**SKILLS** **Students will be able to:**	**CROSS CUTTING CONCEPTS** **Students will apply:**
MS-PS1-1 MS-PS1-2 MS-PS1-3	**Periodic Table** ● A substance is a form of matter with a unique composition and distinct physical and chemical properties that can be used to identify it. ● Substances can be represented with common names, chemical names, and chemical formulas ● All substances are composed of one or more of approximately 100 elements. ● An element can be identified by its physical and chemical properties such as density, melting point, boiling point, and magnetism. ● Elements can be grouped together according to similar chemical and physical properties. ● The relative abundance of elements varies with location in the universe. ● Predictions about elements can be made based on their physical and chemical properties and their location on the modern Periodic Table.	● Observe a mystery mixture and develop a plan for testing pairs of substances to discover which two are in the mystery mixture. ● Use various laboratory techniques to determine the chemical and/or physical properties of an element ● Group elements according to their physical and chemical properties ● Relate element groupings to the modern Periodic Table ● Use location on the Periodic Table to make predictions about an unknown element's properties	● Patterns ● Cause and Effect

	Key Terms: Substance, matter, element, density, metal, nonmetal, inert gases, reactivity, malleable, ductile, luster		
MS-PS1-2 MS-PS1-4	**Particle Model** ● Gas is matter—it has mass and occupies space. ● Matter is made of particles. ● Gas compresses when force is applied; gas expands when force is withdrawn. ● During compression and expansion, the number and character of particles in a sample of gas do not change; the space between the particles does change. ● Gases are composed of widely spaced individual particles in constant motion. ● There is nothing between gas particles except space. Key Terms: Compressed, particles, expansion, matter	● Observe the inflation of a balloon placed over a sodium bicarbonate and citric acid reaction ● Conduct controlled experiments to determine the volume of gas produced ● Investigate air to confirm that it qualifies as matter—it has mass and occupies space. ● Use syringes to discover that air can be compressed and expanded. ● Develop explanations for their observations ● Refine their model of air (gas) as independent particles with significantly large distances between them. ● Use representations to show the changes in particle density during compression	● System and system models ● Cause and effect
MS-PS1-4 MS-PS3-3 MS-PS3-4 MS-PS3-5 MS-ETS1-1 MS-ETS1-2 MS-ETS1-3 MS-ETS1-4	**Energy and Matter** ● Matter exists in three phases: solid, liquid and gas, which are defined by the relative amount of particle motion in a substance. In solids, atoms are locked in position and only vibrate. In liquids, atoms are loosely connected and slide around. In gases, atoms are disconnected except for collisions.	● Use a laboratory thermometer to accurately measure the temperature of a substance ● Plot a line graph of temperature measurements taken over time ● Identify melting and boiling points of a substance in a graph of temperature over time	● System and system models ● Cause and effect ● Patterns ● Stability and Change ● Energy and matter ● Structure and Function

	● Kinetic energy is energy of motion. ● Energy transfers between particles when they collide. Energy transfer by contact is conduction ● Energy is conserved. The amount of energy in a system does not change—no energy is ever created, and no energy is ever destroyed. ● Heat (energy transfer) is measured in calories. One calorie is the amount of heat needed to raise the temperature of 1 mL of water 1 degree Celsius. ● Phase changes are a result of changes in heat energy which determines particle motion. This is a physical change. ● Pure substances have characteristic intrinsic properties such as melting point and boiling point, which are independent of the amount of the sample. ● When a substance changes phase, the mass is conserved. No matter is created or destroyed, so the mass of an amount of substance at one phase is equal to the mass of that same amount of substance in another phase. ● Engineers try to solve problems that satisfy a set of criteria and that conform to constraints placed on a solution to the problem <u>Key Terms:</u> phase, solid, liquid, gas, particle, molecule, atom, matter, kinetic energy, heat energy, kinetic molecular model, Conservation of Mass, physical change, melting point, boiling point, calorie	● Combine temperature data, observational data, and scientific reasoning to make claims about energy and phase changes ● Use the kinetic molecular model to predict how solids, liquids, and gasses would behave under various physical circumstances, such as heating or cooling ● Use boiling point and melting point data to determine the identity of an unknown substance. ● Engage in group discussions, listen to mini-lectures, watch interactive animations, and participate in a structured classroom reading. ● Apply understanding of the phases of matter to authentic scenarios ● Use their understanding of energy transfer to face an engineering problem:	

MS-PS1-1 MS-PS1-2 MS-PS1-4	**Solutions** ● Dissolving is an interaction between two substances in which one substance breaks apart and goes into another substance. ● A mixture is a combination of two or more substances. ● Dissolving occurs when one substance (solute) is reduced to particles and is distributed uniformly throughout the particles of a second substance (solvent). ● Dissolving involves both kinetic interactions (collisions) and attractive forces (bonds). ● Not all substances are soluble in water. ● Solutions can be separated back into their original components, which are not chemically changed. Key Terms: solute, solvent, melting dissolving	● Observe and describe candy-coated chocolate pieces in four different environments ● Generate definitions for melting and dissolving, based on their observations. ● Make two aqueous mixtures, one with soluble sodium chloride and one with insoluble calcium carbonate. ● Compare the two mixtures and attempt to separate them with filters. ● Separate the salt solution into its original components, using evaporation	● Patterns ● Cause and effect
MS-PS1-4 MS-PS1-6 MS-PS3-4 MS-ETS1-1 MS-ETS1-2 MS-ETS1-3 MS-ETS1-4	**Phase Change** ● Matter exists on Earth in three common states—solid, liquid, and gas. ● 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. ● The temperatures at which phase changes occur are different for different substances.	● Heat three materials and observe the results. ● Observe change of state from liquid to solid and discover that the materials melt at different temperatures. ● Work on a mental model to explain what happens at a particle level when a substance changes state from solid to liquid. ● Use candles to increase the energy transferred to wax and sugar.	● Patterns ● Cause and Effect ● System and system models ● Energy and Matter ● Stability and change

	• During phase change, particles do not change; relationships between particles do change • In gases, particles move independently through space • The processes of phase change are evaporation, condensation, melting, freezing sublimation, and deposition Key Terms: phase, solid, liquid, gas, particle, molecule, atom, matter, kinetic energy, heat energy, kinetic molecular model, physical change, melting point, boiling point,	• Use data and their experience designing a thermos to design a "freezer" that will freeze water in the classroom. • Investigate all three ordinary states of matter, using a condensation apparatus. • Develop an explanation of the system, using their particle model.	
MS-PS1-1 MS-PS1-2 MS-PS1-5	**Reactions** • Atoms combine to make particles of substances: molecules and ionic compounds. • Molecules and ionic compounds are held together by attractive forces called bonds. • 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 matter is conserved. • 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. • Reactants that remain in their original form after a reaction has run to completion were present in excess.	• Construct two-dimensional representations of compounds—molecules and ionic compounds. • Make and analyze representations of particles of familiar substances. • Use atom tiles to represent of the reactant molecules and rearrange them to make product molecules. • Write a balanced chemical equation for the reaction, using standard conventions. • Use syringe-and-bottle system to compare volumes of gas produced with equal volumes of two solutions. • Work individually and in groups to review the big concepts.	• Cause and Effect • System and system models • Scale, proportion and quantity • Stability and change

	Key Terms: Compounds, bonds, reactants, products, limiting factor		

Unit Chemical Interactions
Grade 8

TIME FRAME	TOPIC	PERFORMANCE TASKS ACTIVITIES/PROJECTS ASSESSMENTS	RESOURCES/INTERDISCIPLINARY CONNECTIONS
September *10 Periods*	Periodic Table	Investigation 1: Substances Part 1: Mystery Mixture Part 2: Mixing Substances *Students share digital images with the Foss community* **Assessment**: Survey, Science and Engineering practices Investigation 2: Elements Part 1: Periodic Table Part 2: Elements in the World *Make an element use - table* *Share digital images with Foss community.* **Assessment:** Science and Engineering practices, Response sheet, Investigations 1-2 I-check	**FOSSWeb Resources** Two substance reactions Periodic Table of the Elements **Additional Resources** Elements Harcourt School: Zooming in on Matter Interactive Periodic Table SMART Notebook lesson: Families and Periods SMART Notebook lesson: Using the Periodic Table Song: Elements Song: Meet the Elements TD Interactive Periodic Table USIS Vol. 1 – Is It Made of Molecules, pg.85 BrainPOP: Metals

			SMART Notebook lesson: Metals and Nonmetals USIS Vol. 1 – Rusty Nails, pg. 91 BrainPOP: pH Scale BrainPOP: Acids and Bases SMART Notebook lesson: Acids and Bases SMART Notebook lesson: Acid Base Venn Diagram Kitchen Chemistry Interactive
September- October 8 Periods	Particle Model	Investigation 3: Particles Part 1: Capture in the Gas Part 2: Air is Matter Part 3: Air as Particle *Teacher Created project & Problem to solve* **Assessment:** Science and Engineering practices, Science notebook entry, key point chart, Investigation 3-I- check	FOSSWeb Resources Gas in a Syringe Particles in gases
October- November *21 periods*	Energy and Matter	Investigation 4: Kinetic Energy Part 1: Gas Expansion/ Contraction Part 2: Liquid Expansion/Contraction Part 3: Solid Expansion/ Contraction **Assessment:** Science notebook entry, response sheet, key point chart, Investigation 4-I- check *Read and summarize article "Expansion and contraction"* Investigation 5: Energy Transfer Part 1: Mixing Hot and Cold Part 2: Particle Collisions Part 3: Heat	**FOSSWeb Resources** Particles in Solids, Liquids, and Gases Bottle Thermometer Setup Brass Sphere and Ring Demonstration Energy Flow Mixing Hot and Cold Water Energy Transfer by Collision Thermometer **Additional Resources**

		Additional Science problems **Assessment-** Response sheet, science and engineering practices, Investigation 5- I-Check Investigation 6: Thermos Engineering Part 1: Insulation Part 2: Thermos Design *Use Google Docs/Slides for presentation* **Assessment-** Science and engineering practices	Harcourt School: Heat makes a difference Harcourt School: States of Matter Nature of Matter Video SMART Notebook lesson: States of Matter Song: Solid, Liquid, Gas BrainPOP: Matter Changing States BrainPOP: States of Matter Uncovering Student Ideas In Science (USIS) Vol. 2 –Freezing Ice, pg.59 USIS Vol. 3 - Is It a Solid, pg.25
November 3 Periods	Solutions	Investigation 7: Solutions Part 1: Dissolve and Melt Part 2: Solubility *Explore Saturation* *Explore Concentration* **Assessment-** Quick write, science notebook entry, science and engineering practices	**FOSSWeb Resources** Exploring dissolving **Additional Resources** Harcourt School: Melting and Boiling
December 9 Periods	Phase Change	Investigation 8: Phase Change Part 1: Melting Temperature Part 2: Adding Thermal Energy Part 3: Freeze Water Part 4: Changing Phase *Explore melting temperature of margarine and other solids.* **Assessment-**quick write, science and engineering practices, response sheet, science notebook entry, Investigation 7-8 I-check.	**FOSSWeb Resources** Particles in Solids, Liquids, and Gases Aluminum Foil Spoon Construction Hoar Frost **Additional Resources** Vernier Lab: Freezing Temperature of Water Vernier Lab: Boiling Temperature of Water Vernier Lab: How Low Can You Go? Vernier Lab: Ziploc Ice Cream

December- January *12 Periods*	Reactions	Investigation 9: Reaction Part 1: Substance Models Part 2: Limewater Reaction Part 3:Baking Soda and Acid *Teacher created projects* *Explore the rust reaction* **Assessment-** Science notebook entry, response sheet, science and engineering practices, Investigation 9 I-Check Investigation 10: Limiting Factor Part 1: Citric Acid and Baking Soda Part 2: Identifying Key Ideas *Problem solving for engineering design* **Assessment-** Science notebook entry, science and engineering practices, Post kit test	**FOSSWeb Resources** Burning Sugar Demonstration **Additional Resources** PhET: Balancing Chemical Equations interactive USIS Vol. 1 – Ice Cubes in a Bag, pg. 49 USIS Vol. 1 – Lemonade, pg. 55 BrainPOP: Physical and Chemical Changes Electrolysis Video PhET: Build a Molecule Interactive l Properties and Changes Song: Atoms in My Life USIS Vol. Chemical Bonds, pg. 71,

UNIT: Earth History
Grade 8

ENDURING UNDERSTANDINGS	ESSENTIAL QUESTIONS
✓ The Earth can be separated into various spheres which interact dynamically. ✓ Changes in the Earth's surface are caused by constructive and destructive forces.	✓ How do Earth's systems work? ✓ Where does energy go?

NGSS	KNOWLEDGE Students will know:	SKILLS Students will be able to:	CROSS CUTTING CONCEPTS Students will apply:

MS-ESS1-4	**Grand Canyon Rock Layers** ● Rock layers are three dimensional features whose sequences are the same from one location to another along the Grand Canyon. ● Different rates of erosion are caused by differences in the properties in the rock layers, such as hardness, brittleness and composition. ● Earth's surface has of a variety of different landforms and water features. ● Limestone, sandstone, and shale are rocks found in the Grand Canyon that can be identified by their characteristics Key Terms: composition, brittleness, properties, deposition, erosion,	● Compare and correlate rock data from two locations ● Explain horizontal lines on canyon walls ● Use acid to test for a specific substance in a rock sample ● Create explanations about constructive and destructive forces based on observed information of rocks and landforms ● Apply understanding of constructive and destructive forces to authentic scenarios	● Patterns ● System and model system ● Scale, proportion and quantity
MS-ESS2-1 MS-ESS2-2 MS-ESS1-4	**Sediments and Soils** ● Sediments form through the processes of chemical and physical weathering. Some sediment materials are derived from organic materials such as remains of marine organisms. ● Sediments turn into solid rock (such as sandstone, shale, and limestone) through the process of lithification, which involves compaction, cementation, and dissolution	● Sort a rock mixture by hand and model how wind can separate earth materials ● Identify sediments within a sedimentary rock ● Identify sediments within soil ● Test the chemical properties of soils and evaluate samples to select appropriate locations for gardening ● Create sand and consider how rocks experience abrasion and other forms of physical weathering	● Patterns ● Stability and change ● Scale, proportion and quantity

	• Soils contain sediments as well as organic material from decomposed plants, animals, and bacteria. Like rocks, soils are often found in layers, each having a different chemical composition and texture. • Eroded sediments can be transported by water, wind, or ice and deposited in new locations. • The same Earth forces that occurred in the past occur today. This principle is called Uniformitarianism. • Rocks are constantly being changed by physical and chemical weathering. • The relative ages of sedimentary rock can be determined by the sequence of layers. Lower layers are older than higher layers Key Terms: cementation, crystallization, compaction, deposition, physical weathering, chemical weathering, erosion, landforms and sediments, soils, lithification	• Make observations of sand properties and relate to the processes that created the sample • Model the formation of sedimentary rocks in an ancient environment • Test two oceanic materials to see what might be a component of limestone. • Describe the creation of rock layers in the Grand Canyon • Model the Earth Processes of erosion and deposition in a stream table and analyze how variables affect the system • Apply understanding of sediments and soils to authentic scenarios	
MS-ESS2-6 MS-ESS1-4 MS-LS4-1 MS-LS4-2	**Fossils** • Fossils provide evidence of how life and environmental conditions have changed over time. • Index fossils can be used as indicators for the relative age of sedimentary rock layers, older rocks = older fossils.	• Use index fossils to correlate rock layers • Compare various events and fossils to derive an order of succession over geological time • Make inferences from fossil evidence that contribute to an explanation of fossil succession	• Patterns • Scale, proportion and quantity

	Key Terms: fossils, index fossils, environment, relative age, absolute age, catastrophic events	• Apply understanding of fossils to authentic scenarios	
MS-ESS2-1 MS-ESS2-2 MS-ESS2-3 MS-ESS3-1 MS-ESS3-2	**Plate Tectonics** • The Earth is layered with a lithosphere, a hot convecting mantle, and a dense metallic core. • The solid crust of the Earth, including both the continents and the ocean basins, is made up of separate tectonic plates. The plates ride on a denser, hot, gradually deformable layer of the Earth. • Heat inside the earth melts rock; melted rock can cool and form igneous rocks • When plates interact, high heat and immense pressure can change rock into new forms of rock (metamorphic rock). • Major geological events, such as earthquakes, volcanic eruptions, and mountain building result from the motion of tectonic plates. • Sea floor spreading and subduction zones are evidence for the theory of plate tectonics. Key Terms: tectonic plates, dense, molten, subduction, uplifting, sea-floor spreading, Ring of Fire, igneous, asthenosphere, Wegener's theory stratigraphic column,	• Use salol to model the cooling of igneous rocks and design an experiment to test the effect of cooling rate on crystal formation. • Model the interactions between the layers of the Earth • Analyze authentic earthquake data to determine the locations of tectonic plate boundaries • Model types of interactions at plate boundaries that cause earthquakes, volcanic eruptions, mountain building, and sea floor spreading • Present evidence to support arguments for the theory of Plate Tectonics • Apply understanding of plate tectonics to authentic scenarios	• System and system models • Scale, proportion and quantity • Patterns • Stability and Change

MS-ESS2-1 MS-ESS2-2 MS-ESS3-1 MS-ESS3-2 MS-ESS3-3 MS-ESS3-4 MS-ESS3-5 MS-ESS1-4	**Geoscenarios** ● 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. ● 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. ● 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.	● Develops a time line of events related to their place or process. ● Develop presentations. ● Review the processes that drive the rock cycle and the constructive and destructive processes that shape Earth. ● Explore various careers in the geosciences.	● System and system models ● Scale, proportion and quantity ● Stability and Change

Unit Earth History
Grade 8

TIME FRAME	TOPIC	PERFORMANCE TASKS ACTIVITIES/PROJECTS ASSESSMENTS	RESOURCES/INTERDISCIPLINARY CONNECTIONS
January *8 periods*	Grand Canyon Rock Layers	Investigation 1: Earth is Rock Part 1: What's the Story of this Place?	**FOSSWeb Resources** Landforms Tour

		Part 2: Grand Canyon Rocks Part 3: Correlating Grand Canyon Rocks *View Colorado River Expedition* *Share digital images with the FOSS community* *Discuss human history at the Grand Canyon* *Research Native American activities* *Tour national parks in 3D* *View National Park Service web cameras* *View National Parks presentations* *Review American Geological Institute resources* **Assessment:** Survey, Science notebook entry, Quick write, Scientific practices, Quick write	Scale Model Grand Canyon Flyover Powell's River Trip Grand Canyon Rocks Correlation **Additional Resources** BrainPOP: Erosion Grand Canyon Formation Video Grand Canyon National Park Site Harcourt School: The Grand Canyon Harcourt School: The Rock Cycle SMART Notebook lesson: Rock Cycle
January February *6 blocks*	Sediments and Soils	Investigation 2: Weathering and Erosion Part 1: Sorting Earth Materials Part 2: Stream Table Part 3: Weathering *Propose a sorting challenge* *View stream-table simulations* *View debris-flow videos* *Share digital images with the FOSS community* *View multimedia: "Sand types"* *Investigate sand-formation variables* *Create a sand museum* *Explore chemical weathering* *Read about the Ogallala Aquifer* *Encourage further soil studies* *View "Dig It! The secrets of soil"* **Assessment:** Scientific practices, science notebook entry, quick write, response sheet, Investigations 1-2 I-Check	**FOSSWeb Resources** Stream Table High vs Low Flow Grand Canyon Flood Frost Wedging Rock Fall Sandstone Formation Shale Formation Zion National Park Expedition Limestone Formation Rock Column Movie Maker Rock Database Sedimentary Rocks Tour **Additional Resources** BrainPOP: Soil BrainPOP: Weathering Vernier Lab: Soil Study

		Investigation 3: Deposition Part 1: Sandstone and Shale Part 2: Limestone Part 3: Interpreting Sedimentary Layers *Create model sedimentary rocks* *Share digital images with the FOSS community* *Explore famous landmarks* *Explore beneath the Ocean Floor with the JOIDES Resolution* **Assessment**: Science notebook entry, scientific practices, quick write, Investigations 3 I-check	
February March *3 blocks*	Fossils	Investigation 4: Fossils and Past Environments Part 1: Fossils Part 2: A Long Time Ago Part 3:Student Time Lines Part 4: Index Fossils *Add Grand Canyon rocks to the student time* *View fossil gallery* *View a Grand Canyon geological time clock* *View the Grand Age of Rocks: The Numeric Ages for Rocks exposed within Grand Canyon* *View interactive time line* **Assessment**: Rock Column movie maker, Response sheet, scientific purposes, Investigation 4 I-check	**FOSSWeb Resources** Rock Column Movie Maker Limestone Formation Sandstone Formation Shale Formation Timeliner Time Machine Index-Fossil Correlation Dating Rock Layers **Additional Resources** BrainPOP: Fossils Harcourt School: How a fossil forms SMART Notebook Lesson: Fossils Song: I am a Paleontologist Song: Fossil Man BrainPOP: Geologic Time

March *18 periods*	Plate Tectonics	Investigation 5: Igneous Rock Part 1: Earth's Layers Part 2: Salol Crystals *Grow Rock-candy crystals* *View minerals in our environment* *Research gemstones in the U.S.* *Explore The Life Cycle of a Mineral Deposit* *Share digital Images with the FOSS community* *Research gigantic crystals* **Assessment:** Scientific practices, science notebook entry, Investigation 5 I-Check Investigation 6: Volcanoes and Earthquakes Part 1: Mapping Volcanoes and Earthquakes Part 2: Moving Continents Part 3: Plate Tectonics *Research disaster preparedness* *View animations for earthquake terms and concepts* *View IRIS education and public outreach* *View US Geological Survey earthquake hazards resources* *View US Geological Survey volcano hazards resources* *View volcano hazards program webcams* *Search the volcano location database* *View plate tectonics visualizations* **Assessment:** Scientific practices, science notebook entry, quick write, investigation 6 I-check Investigation 7: Mountains and Metamorphic Rocks Part 1: Plate Models Part 2: Metamorphic Rocks Part 3: Shenandoah (Optional)	**FOSSWeb Resources** Pacific Northwest Tour Earth's Interior Salol Crystal Formation Extrusive Rock Formation Intrusive Rock Formation Yosemite National Park Field Trip Hawaii Field Trip Rock Database Longitude and Latitude Volcano Plotting Activity Volcanoes around the World Volcanoes Formation Earthquake Plotting Activity Earthquakes around the world Convection Folding Mountain Types Mountain-Card Locations Appalachian Mountain Tour How Metamorphic Rocks Form Slate Shenandoah Valley The Geological Story of Shenandoah Mountain Folding and Erosion **Additional Resources** Mount St. Helens: The eruption Impact NOAA Plate Tectonics BrainPOP: Plate Tectonics, Ring of Fire Plates and Boundaries

		Add to time lines *View animated plate tectonics* *Find plate boundaries* *Research igneous and metamorphic rocks* *Take a virtual tour of Shenandoah* **Assessment:** Scientific practices, quick write, investigation 7 I-check, science notebook entry	Harcourt School: Earth's Layers Harcourt School: Strike Slip Fault Song: Rumble, Rumble
March 9 Periods	Geoscenarios	Investigation 8 : Geoscenarios Part 1: Introduction to the Project Part 2: Team Synthesis Part 3: Presentations *View Earth Science World Image Bank* *Explore local geological history* *Tour national park geology* *Access more local resources* **Assessment:** Scientific practices, Geoscenario presentation Investigation 9: What is Earth's Story? Part 1: Revisit the Grand Canyon Part 2: Review the Evidence *Invite a speaker* *Continue to tell the geological story of your place* *Not just rocks: Check out Earth Science careers* *Explore Schoolyard Geology* **Assessment:** Science notebook entry, revisit quick write, scientific practices, posttest	**FOSSWeb Resources** Geoscenarios Timeliner Rock Column Movie Maker Grand Canyon Revisited Colorado Plateau Over Time

ENDURING UNDERSTANDINGS	ESSENTIAL QUESTIONS
✓ The chronological fossil record documents the existence, diversity, extinction, and change of life forms throughout history and life on Earth. ✓ Variation in a population can occur due to random genetic mutations, which can have harmful, helpful or no effects. ✓ An adaptation is an inherited trait that increases an organism's chances of surviving in an environment long enough to pass on its genes. ✓ Natural selection is a process by which individuals best adapted to their environment tend to survive and pass on its genes.	✓ What does the fossil record tell us about how life has changed on Earth? ✓ What leads to variations in a population? ✓ How are humans influencing inheritance?

NGSS	KNOWLEDGE Students will know:	SKILLS/ PRACTICES Students will be able to:	CROSSCUTTING CONCEPTS Students will apply
MS-LS4-1 MS-LS4-2	**History of Life** ● The chronological fossil record documents the existence, diversity, extinction, and change of life-forms throughout Earth's history. ● The fossil record is incomplete because of the nature of fossilization. ● Structural similarities between ancient and modern organisms is one kind of evidence from which we can infer relatedness.	● Observe a collection of fossils and find out more about the organisms and when they lived. ● Construct a time line of Earth's history and assign dates to the fossil samples. ● Explore the fossil evidence that supports current theories of how this transition occurred, based on limb structure.	● Patterns ● Scale, Proportion, and Quantity ● Structure and Function

		• Predict what an organism may have looked like in the millions of years between two of the fossils. • Dissect an owl pellet, and search for limb-structure similarities between the prey organisms and the extinct organisms they learned about earlier.	
MS-LS3-1 MS-LS3-2 MS-LS4-2 MS-LS4-3	**Heredity** • A cladogram is a model that demonstrates evolutionary relationships among organisms. • Embryo development can be used to identify relationships not evident in adults of different species. • Heredity explains why organisms are similar but not identical to their parents. • Genes on DNA code for proteins that are responsible for an organism's traits. • Variation of traits in a population is established in part as a result of sexual reproduction. • A Punnett square is a model used to predict the probability of inheriting genotypes in individuals of a population.	• Examine a human family tree and then build a vertebrate cladogram. • Use embryological data to determine where a dolphin fits in their cladogram. • Explore the variation of four features to determine what traits they have. • Determine the distribution of the traits in the class. • Study a population of larkeys, a make-believe animal, to analyze their traits. • Use an online simulations to model and predict the inheritance of traits in a larkey population. • Use Punnett squares to predict the probability of offspring traits when the genotypes of parents are known. • Compare the probabilities of inheritance in individual offspring and populations.	• Patterns • Cause and Effect

MS-LS3-1 MS-LS4-4 MS-LS4-5 MS-LS4-6	**Evolution** ● Variation in a population can occur due to random genetic mutations, which can have harmful, helpful, or no effects. ● An adaptation is an inherited trait that increases an organism's chances of surviving in an environment long enough to pass on its genes. ● Natural selection is a process by which individuals in a population best adapted to their environment tend to survive and pass their traits to subsequent generations. ● Change in populations by means of natural selection is the basis for the theory of evolution, which best explains the biodiversity on Earth. ● Humans use genetic technologies to influence inheritance.	● Use online activities to explore the adaptation of color in walking sticks. ● Use online activities to track a population of walking sticks over five generations. ● Consider how natural selection affects the incidence of walking stick color over time. ● Research different genetic technologies. ● Assess how those technologies might address current genetic issues. ● Communicate their findings to classmates	● Patterns ● Cause and Effect ● System and System Models ● Stability and Change

Unit Heredity and Adaptation
Grade 8

TIME FRAME	TOPIC	PERFORMANCE TASKS ACTIVITIES/PROJECT ASSESSMENT	RESOURCES/INTERDISCIPLINARY CONNECTIONS
May *9 Periods*	History of Life	Investigation 1 History of Life Part 1: The Fossil Record Part 2: Transitions *Teacher created projects* *Google slides* **ASSESSMENT-**entry level survey, Investigation 1-I-Check, notebook entry, quick write	**FOSSWeb Resources** An interview with Jennifer Clack Fossils slide show Biodiversity slide Videos and Slideshows Fish and fingers Great Transitions- The origin of Tetrapod
May *10 Periods*	Heredity	Investigation 2 Heredity Part 1: Lines of Descent Part 2: Inheriting Traits Part 3: Modeling Heredity Part 4: Punnett Square *Teacher created projects* *Google slides* *Self- assessment and reflection* **ASSESSMENT-** Investigation2 I-Check, quick write, notebook entry	**FOSSWeb Resources** A Model for Predicting Genetic Variation Larkey Punnett Square Larkey Impossible Traits Heredity Slide Show

May *9 Periods*	Evolution	Investigation 3 Evolution Part 1: Adaptation Part 2: Natural Selection Part 3: Genetic Technology *Teacher created activities* *Google slides models/ projects* *Self -assessment* **Assessment-** Investigation 3 I- Check, quick write, exit slip, notebook entry	**FOSSWeb Resources** Walking Sticks: Eat insects Walking Sticks: Find insects in Three Environments Larkey's Natural Selection Videos and Slide Show The Making of the Fittest: Natural Selection and Adaptation The Origin of Species: The Beak of the Finch Biodiversity- Slide Show

UNIT: Human System Interactions
Grade 8

ENDURING UNDERSTANDINGS	**ESSENTIAL QUESTIONS**
✓ Cells work together in tissues, organs, and organ systems.	✓ How do the eyes work as part of a system?

NGSS	**KNOWLEDGE** **Students will know:**	**SKILLS** **Students will be able to:**	**CROSS CUTTING CONCEPTS** **Students will apply**
MS-LS1-1 MS-LS1-3	**Systems** ● Multicellular organisms are complex systems composed of organ systems, which are made of organs, which are made of tissues, which are made of cells. ● Cells are made of cell structures, which are made of molecules, which are made of atoms. ● The human body is a system of interacting subsystems.	● Research a diagnosis focusing on human organ systems. ● Make a diagnosis of a patient, arguing their case to other students.	● Scale, Proportion and quantity ● Cause and Effect ● Structure and Function ● Systems and system models

	Key Terms: cell, tissue, organ, organ system		
MS-LS1-3 MS-LS1-7	**Cells** ● The human body is a system of interacting subsystems. ● The respiratory system supplies oxygen and the digestive system supplies energy (food) to the cells in the body. ● The circulatory system carries food and oxygen to the cells in the body and carries waste products to the excretory/respiratory systems for disposal. ● Aerobic cellular respiration is the process by which energy stored in food molecules is converted into usable energy for cell. ● Key Terms: respiratory system, digestive system, cellular respiration, cell, tissue, organ, organ system	● Manipulate an online activity to add detail to their ideas. ● Construct a model to illustrate the pathways that oxygen and energy (food) take from the external environment to a muscle cell in the leg. ● Model the substances and steps in aerobic cellular respiration. .	● Systems and system models ● Scale, Proportion and quantity ● Energy and Matter
MS-LS1-3 MS-LS1-8	**The Nervous System** ● Sensory receptors respond to an array of mechanical, chemical, and electromagnetic stimuli. ● Sensory information is transmitted electrically to the brain along neural pathways for processing and response. ● Neural pathways change and grow as information is acquired and stored as memories.	● Compare touch sensitivity between fingertips and knuckles to learn about pressure receptors and receptive fields ● Develop a model to explain how messages are transmitted along neurons and across synapses, to and from the brain. ● Identify scents, and the sense of sight by testing reaction time.	● Scale, Proportion and quantity ● Structure and Function ● Cause and effect ● Systems and system models ● Patterns

	Key Terms: sensory receptors, stimuli, neurons	• Read about chemical receptors and photoreceptors and consider how their eyes are designed to interpret electromagnetic information. • Use mirror drawing to explore the connection between hand–eye coordination, learning, and memory. • Look for patterns to determine strategies for improving short-term memory.	

Unit Human System Interactions
Grade 8

TIME FRAME	TOPIC	PERFORMANCE TASKS ACTIVITIES/PROJECTS ASSESSMENT	RESOURCES/INTERDISCIPLINARY CONNECTIONS
March *5 Periods*	Systems	Investigation 1 System Connections Part 1: Human Body Structural Levels Part 2: System Research *Research diseases* *Talk to a doctor* *Research other human organ systems* *Research standard first aid*	**FOSSWeb Resources** Levels of Complexity Doctor Video 1 Human Systems Structural Levels

		Assessment: Entry-level survey, science notebook entry, performance assessment	
April *7 Periods*	Cells	Investigation 2: Supporting Cells Part 1: Food and Oxygen Part 2: Aerobic Cellular Respiration *Research aerobic cellular respiration* *Research bacteria* *Research mitochondrial disease* **Assessment:** Response sheet, performance assessment, Investigations 1-2 I-check	**FOSSWeb Resources** Human Cardiovascular System Digestive and Excretory Systems Circulatory and Respiratory Systems
April *14 Periods*	The Nervous System	Investigation 3: The Nervous System Part 1: Interacting with the Environment Part 2: Sending a Message Part 3: Other Senses Part 4: Learning and Memory *Measuring sounds levels* *Research different kinds of hearing aids* *Compare sensory systems of different animals* *Find out more about Helen Keller* **Assessment**: Science notebook entry, response sheet, Investigation 3 I-check, Posttest	**FOSSWeb Resources** Touch Menu Brain: Synapse Function Smell Menu Vision Menu Reaction Timer **Additional Resources** BrainPOP: Neurons BrainPOP: Nervous System BrainPOP: Brain SMART Notebook lesson: Central Nervous System Song: Parts of the Brain Song: Whatta Brain Song: Come On, Use Your Brain

Resources

Appendix F Science & Engineering Practices

Appendix G Crosscutting Concepts

NJ Technology Resources