CURRICULUM

FOR

SCIENCE

GRADE 6

This curriculum is part of the Educational Program of Studies of the Rahway Public Schools.

ACKNOWLEDGMENTS

Dr. Susan Dube, Program Supervisor of Science and Technology Education

The Board acknowledges the following who contributed to the preparation of this curriculum.

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Subject/Course	Date of Board Adoption
SCIENCE	**September 21, 2021**
Grade 6	

RAHWAY PUBLIC SCHOOLS CURRICULUM

SCIENCE- Grade 6

PACING GUIDE

Unit	Title	Pacing
1	Weather and Climate	8 weeks
2	Thermal Energy	8 weeks
3	Waves/Electromagnetic Spectrum	8 weeks
4	Astronomy	8 weeks
5	Growth, Development, and Reproduction of Organisms	8 weeks

ACCOMMODATIONS

504 Accommodations:	**IEP Accommodations:**
• Provide scaffolded vocabulary and vocabulary lists. • Provide extra visual and verbal cues and prompts. • Provide adapted/alternate/excerpted versions of the text and/or modified supplementary materials. • Provide links to audio files and utilize video clips. • Provide graphic organizers and/or checklists. • Provide modified rubrics. • Provide a copy of teaching notes, especially any key terms, in advance. • Allow additional time to complete assignments and/or assessments. • Provide shorter writing assignments. • Provide sentence starters. • Utilize small group instruction. • Utilize Think-Pair-Share structure. • Check for understanding frequently. • Have student restate information. • Support auditory presentations with visuals. • Weekly home-school communication tools (notebook, daily log, phone calls or email messages). • Provide study sheets and teacher outlines prior to assessments. • Quiet corner or room to calm down and relax when anxious. • Reduction of distractions. • Permit answers to be dictated. • Hands-on activities. • Use of manipulatives. • Assign preferential seating. • No penalty for spelling errors or sloppy handwriting. • Follow a routine/schedule. • Provide student with rest breaks. • Use verbal and visual cues regarding directions and staying on task. • Assist in maintaining an agenda book.	• Provide scaffolded vocabulary and vocabulary lists. • Differentiate reading levels of texts (e.g., Newsela). • Provide adapted/alternate/excerpted versions of the text and/or modified supplementary materials. • Provide extra visual and verbal cues and prompts. • Provide links to audio files and utilize video clips. • Provide graphic organizers and/or checklists. • Provide modified rubrics. • Provide a copy of teaching notes, especially any key terms, in advance. • Provide students with additional information to supplement notes. • Modify questioning techniques and provide a reduced number of questions or items on tests. • Allow additional time to complete assignments and/or assessments. • Provide shorter writing assignments. • Provide sentence starters. • Utilize small group instruction. • Utilize Think-Pair-Share structure. • Check for understanding frequently. • Have student restate information. • Support auditory presentations with visuals. • Provide study sheets and teacher outlines prior to assessments. • Use of manipulatives. • Have students work with partners or in groups for reading, presentations, assignments, and analyses. • Assign appropriate roles in collaborative work. • Assign preferential seating. • Follow a routine/schedule.

Gifted and Talented Accommodations:	**ELL Accommodations:**
• Differentiate reading levels of texts (e.g., Newsela). • Offer students additional texts with higher lexile levels. • Provide more challenging and/or more supplemental readings and/or activities to deepen understanding. • Allow for independent reading, research, and projects. • Accelerate or compact the curriculum. • Offer higher-level thinking questions for deeper analysis. • Offer more rigorous materials/tasks/prompts. • Increase number and complexity of sources. • Assign group research and presentations to teach the class. • Assign/allow for leadership roles during collaborative work and in other learning activities.	• Provide extended time. • Assign preferential seating. • Assign a peer buddy who the student can work with. • Check for understanding frequently. • Provide language feedback often (such as grammar errors, tenses, subject-verb agreements, etc…). • Have student repeat directions. • Make vocabulary words available during classwork and exams. • Use study guides/checklists to organize information. • Repeat directions. • Increase one-on-one conferencing. • Allow student to listen to an audio version of the text. • Give directions in small, distinct steps. • Allow copying from paper/book. • Give student a copy of the class notes. • Provide written and oral instructions. • Differentiate reading levels of texts (e.g., Newsela). • Shorten assignments. • Read directions aloud to student. • Give oral clues or prompts. • Record or type assignments. • Adapt worksheets/packets. • Create alternate assignments. • Have student enter written assignments in criterion, where they can use the planning maps to help get them started and receive feedback after it is submitted. • Allow student to resubmit assignments. • Use small group instruction. • Simplify language. • Provide scaffolded vocabulary and vocabulary lists. • Demonstrate concepts possibly through the use of visuals. • Use manipulatives. • Emphasize critical information by highlighting it for the student.

	● Use graphic organizers. ● Pre-teach or pre-view vocabulary. ● Provide student with a list of prompts or sentence starters that they can use when completing a written assignment. ● Provide audio versions of the textbooks. ● Highlight textbooks/study guides. ● Use supplementary materials. ● Give assistance in note taking ● Use adapted/modified textbooks. ● Allow use of computer/word processor. ● Allow student to answer orally, give extended time (time-and-a-half). ● Allow tests to be given in a separate location (with the ESL teacher). ● Allow additional time to complete assignments and/or assessments. ● Read question to student to clarify. ● Provide a definition or synonym for words on a test that do not impact the validity of the exam. ● Modify the format of assessments. ● Shorten test length or require only selected test items. ● Create alternative assessments. ● On an exam other than a spelling test, don’t take points off for spelling errors.

UNIT 1 OVERVIEW

Content Area: Earth Science and Chemistry

Unit Title: Weather and Climate

Target Course/Grade Level: 6th Grade

Unit Summary:

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

Approximate Length of Unit: 8 Weeks

LEARNING TARGETS

NJ Student Learning Standards:

MS-ESS2-4: Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.

MS-ESS2-5: Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions/

MS-ESS2-6: Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates

Interdisciplinary Connections and Standards:

Career Readiness, Life Literacies, and Key Skills:

9.4.8.CI.1: Assess data gathered on varying perspectives on causes of climate change (e.g., cross cultural, gender-specific, generational), and determine how the data can best be used to design multiple potential solutions.

9.4.8.CT.1: Evaluate diverse solutions proposed by a variety of individuals, organizations, and/or agencies to a local or global problem, such as climate change, and use critical thinking skills to predict which one(s) are likely
to be effective (e.g., MS-ETS1-2).
9.4.8.CT.2: Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option.
9.4.8.GCA.2: Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a group goal.
9.4.8.IML.1: Critically curate multiple resources to assess the credibility of sources when searching for information.
9.4.8.IML.3: Create a digital visualization that effectively communicates a data set using formatting techniques such as form, position, size, color, movement, and spatial grouping.
9.4.8.IML.4: Ask insightful questions to organize different types of data and create meaningful visualizations.
9.4.8.IML.12: Use relevant tools to produce, publish, and deliver information supported with evidence for an authentic audience.
9.4.8.TL.1: Construct a spreadsheet in order to analyze multiple data sets, identify relationships, and facilitate data-based decision-making.
9.4.8.TL.2: Gather data and digitally represent information to communicate a real-world problem (e.g., MS-ESS3-4, 6.1.8.EconET.1, 6.1.8.CivicsPR.4).
9.4.8.TL.3: Select appropriate tools to organize and present information digitally.
9.4.8.TL.4: Synthesize and publish information about a local or global issue or event.

Mathematics:
MP.2 Reason abstractly and quantitatively. (MS-ESS2-5),(MS-ESS3-5)
6.NS.C.5 Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation. (MS-ESS2-5)
6.EE.B.6 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (MS-ESS3-5)

NJ SLS Companion Standards: Reading and Writing Standards for History, Social Studies, Science, and
Technical Subjects:
RST.6-8.1. Cite specific textual evidence to support analysis of science and technical texts.
RST.6-8.2. Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.
RST.6-8.3. Follow precisely a multistep procedure when carrying out experiments, taking measurements, or
performing technical tasks.
RST.6-8.7. Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).

NJSLSA.W1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

NJSLSA.W6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

NJSLSA.W7. Conduct short as well as more sustained research projects, utilizing an inquiry-based research process, based on focused questions, demonstrating understanding of the subject under investigation.

WHST.6-8.1. Write arguments focused on discipline-specific content.

A. Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.

B. Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.

C. Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.

D. Establish and maintain a formal/academic style, approach, and form.

E. Provide a concluding statement or section that follows from and supports the argument presented.

Unit Understandings:

Students will understand that…

- Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land. (MS-ESS2-4)
- The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. (MS-ESS2-5)
- Global movements of water and its changes in form are propelled by sunlight and gravity. (MS-ESS2-4)
- Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents. (MS-ESS2-6)
- Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. (MS-ESS2-6)
- Because these patterns are so complex, weather can only be predicted probabilistically. (MS-ESS2-5)
- The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents. (MS-ESS2-6)

Unit Essential Questions:

- What factors interact with and influence weather and climate?
- How do motions and complex interactions of air masses result in changes in weather conditions?
- How does unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates?

Knowledge and Skills:

Students will know...

- Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land.
- Global movements of water and its changes in form are propelled by sunlight and gravity.
- The cycling of water through Earth's systems is driven by energy from the sun and the force of gravity.
- Within Earth's systems, the transfer of energy drives the motion and/or cycling of water.
- The motions and complex interactions of air masses result in changes in weather conditions.
- The complex patterns of the changes in and movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns.
- Examples of data that can be used to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions include weather maps, diagrams, and visualizations; other examples can be obtained through laboratory experiments.
- Air masses flow from regions of high pressure to regions of low pressure, causing weather (defined by temperature, pressure, humidity, precipitation, and wind) at a fixed location to change over time.
- Because patterns of the changes and the movement of water in the atmosphere are so complex, weather can only be predicted probabilistically.
- Sudden changes in weather can result when different air masses collide.
- Weather can be predicted within probabilistic ranges.
- Cause-and effect-relationships may be used to predict changes in weather
- Unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.
- Patterns of atmospheric and oceanic circulation that determine regional climates vary by latitude, altitude, and geographic land distribution.
- Atmospheric circulation that, in part, determines regional climates is the result of sunlight-driven latitudinal banding, the Coriolis effect, and resulting prevailing winds.
- Ocean circulation that, in part, determines regional climates is the result of the transfer of heat by the global ocean convection cycle, which is constrained by the Coriolis effect and the outlines of continents.
- Models that can be used to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates can be diagrams, maps and globes, or digital representations.

Students will be able to...

- Develop and use a model to describe phenomena
- Develop a model to describe unobservable mechanisms.
- Collect data to produce data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions.

EVIDENCE OF LEARNING

Assessment:

What evidence will be collected and deemed acceptable to show that students truly "understand"?

- **End of Unit Assessment**:
  - Students will model and explain the ways water changes its state as it moves through the multiple pathways of the hydrologic cycle
  - Students will develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.
  - Students will collect data and use such data as evidence to explain how complex interactions of air masses result in changes in weather conditions

Learning Activities:

What differentiated learning experiences and instruction will enable all students to achieve the desired results?

- Students will view and manipulate "Earth's Atmosphere" animations on the FOSS website.
- Students will answer the question "What factors interact and influence weather and climate?" beginning with the cycling of water in Earth's systems.
- Students will model the continuous movement of water from land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation. Students will focus on the global movement of water and its changes in form that are driven by sunlight as it heats the Earth's surface water.
- Students can observe the movement of colored water that simulates the movement of hot and cold air masses. Students can observe the cooler water flowing in the direction of the warmer area and equate this with wind being created from the uneven heating of the Earth.
- Students will use models, diagrams, maps, and globes to understand atmospheric and ocean circulation patterns. Since the ocean exerts a major influence on weather and climate by absorbing energy from the sun..
- Students will utilize digital models like NOAA videos to help them visualize how variations in density due to temperature and salinity drive a global pattern of interconnected ocean currents.

RESOURCES

Teacher Resources:

- **FOSS Module**- Weather and Water- FOSS website Investigations 1-3
- **Mosa Mack**- Mosa Mack Weather: In Mosa Mack's Weather unit, students are led through a progression of three inquiry lessons that focus on temperature, pressure, and the corresponding weather patterns
- **PHET Simulations**- Gas Properties- Air Pressure Pump gas molecules to a box and see what happens as you change the volume, add or remove heat, and more. Measure the temperature and pressure, and discover how the properties of the gas vary in relation to each other
- **NSTA Storm Project**- Air Masses of a set of Level 1 activities designed by the Science Center for Teaching, Outreach, and Research on Meteorology (STORM) Project. The authors suggest that previous activities in the unit be completed before Activity 12: Air Masses, including those that address pressure systems and dew point temperature. In Activity 12, the students learn about the four main types of air masses that affect weather in the United States, their characteristic temperatures, and humidity levels as it relates to dew point temperatures.
- **NSTA Ocean Currents** -Ocean Currents and Sea Surface Temperatures- allows students to gather data using My NASA Data microsets to investigate how differential heating of Earth results in circulation patterns in the oceans and the atmosphere that globally distribute the heat. They examine the relationship between the rotation of Earth and the circular motions of ocean currents and air. Students also make predictions based on the data to concerns about global climate change.
- **NSTA- Adopt a Drifter** Adopt a Drifter: Do Ocean Surface Currents Influence Climate? Students construct climographs showing both precipitation and temperature for 3 coastal cities and describe how ocean surface currents affect climate on nearby land.
- **Nearpod:** Nearpod Link *Weather*, *Weather Front*, and *Air Pressure and Weather*
- **BrainPop**: https://www.brainpop.com Weather
- **EdPuzzle**:Related Videos

Equipment Needed:

- Projector with Computer, Whiteboard and High speed internet
- Laboratory equipment as specified for unit
- Online access to FOSS modules (Weather and Water)
- Online access to Mosa Mack platform
- Online access to Nearpod platform
- Online access to PHET simulation

UNIT 2 OVERVIEW

Content Area: Physical Science

Unit Title: Thermal Energy

Target Course/Grade Level: 6th Grade

Unit Summary:

In this unit, students ask questions, plan and carry out investigations, engage in argument from evidence, analyze and interpret data, construct explanations, define problems and design solutions as they make sense of the difference between energy and temperature. They use the practices to make sense of how the total change of energy in any system is always equal to the total energy transferred into or out of the system. The crosscutting concepts of energy and matter, scole, proportion, and quantity, and influence of science, engineering, and technology on society and the natural world are the organizing concepts for these disciplinary core ideas. Students ask questions, plan and carry out investigations, engage in argument from evidence, analyze and interpret data, construct explanations, define problems and design solutions. Students are also expected to use these practices to demonstrate understanding of the core idea

Approximate Length of Unit: 8 weeks

LEARNING TARGETS

NJ Student Learning Standards:

MS-PS3-3: Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer

MS-PS3-4: Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass.

MS-ETS1-1: Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution.

MS-ETS1-2: Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS1-3: Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

MS-ETS1-4: Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Interdisciplinary Connections and Standards:

Career Readiness, Life Literacies, and Key Skills:

9.4.8.CI.1: Assess data gathered on varying perspectives on causes of climate change (e.g., cross cultural, gender-specific, generational), and determine how the data can best be used to design multiple potential solutions.

9.4.8.CT.1: Evaluate diverse solutions proposed by a variety of individuals, organizations, and/or agencies to a local or global problem, such as climate change, and use critical thinking skills to predict which one(s) are likely to be effective (e.g., MS-ETS1-2).

9.4.8.CT.2: Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option.

9.4.8.GCA.2: Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a group goal.

9.4.8.IML.1: Critically curate multiple resources to assess the credibility of sources when searching for information.

9.4.8.IML.3: Create a digital visualization that effectively communicates a data set using formatting techniques such as form, position, size, color, movement, and spatial grouping.

9.4.8.IML.4: Ask insightful questions to organize different types of data and create meaningful visualizations.

9.4.8.IML.12: Use relevant tools to produce, publish, and deliver information supported with evidence for an authentic audience.

9.4.8.TL.1: Construct a spreadsheet in order to analyze multiple data sets, identify relationships, and facilitate data-based decision-making.

9.4.8.TL.2: Gather data and digitally represent information to communicate a real-world problem (e.g., MS-ESS3-4, 6.1.8.EconET.1, 6.1.8.CivicsPR.4).

9.4.8.TL.3: Select appropriate tools to organize and present information digitally.

9.4.8.TL.4: Synthesize and publish information about a local or global issue or event.

Mathematics

6.SP.B.5: Summarize numerical data sets in relation to their context. (MS-PS3-4)

7.EE.3: Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. (MS-ETS1-1),(MS-ETS1-2),(MS-ETS1-3)

7.SP: Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy. (MS-ETS1-4)

NJ SLS Companion Standards: Reading and Writing Standards for History, Social Studies, Science, and Technical Subjects:

RST.6-8.1. Cite specific textual evidence to support analysis of science and technical texts.

RST.6-8.2. Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.

RST.6-8.3. Follow precisely a multistep procedure when carrying out experiments, taking measurements, or

performing technical tasks.

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

NJSLSA.W1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

NJSLSA.W6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

NJSLSA.W7. Conduct short as well as more sustained research projects, utilizing an inquiry-based research process, based on focused questions, demonstrating understanding of the subject under investigation.

WHST.6-8.1. Write arguments focused on discipline-specific content.

A. Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.

B. Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.

C. Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.

D. Establish and maintain a formal/academic style, approach, and form.

E. Provide a concluding statement or section that follows from and supports the argument presented.

Unit Understandings:

Students will understand that…

- Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present. (MS-PS3-3),(MS-PS3-4)
- The amount of energy transfer needed to change the temperature of a matter sample by a given amount depends on the nature of the matter, the size of the sample, and the environment. (MS-PS3-4)
- Energy is spontaneously transferred out of hotter regions or objects and into colder ones. (MS-PS3-3)

Unit Essential Questions:

- What is the relationship between the energy transferred and the change in the average kinetic energy of the particles as measured by the temperature in a system?
- Why is it important to understand and define the criteria and constraints of a design problem?
- How do you develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved?

Knowledge and Skills:

Students will know...

- There are relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of particles as measured by the temperature of the sample.

- Temperature is a measure of the average kinetic energy of particles of matter.
- The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present.
- The amount of energy transfer needed to change the temperature of a matter sample by a given amount depends on the nature of the matter, the size of the sample, and the environment.
- Proportional relationships among the amount of energy transferred, the mass, and the change in the average kinetic energy of particles as measured by temperature of the sample provide information about the magnitude of properties and processes.
- Temperature is a measure of the average kinetic energy of particles of matter.
- The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present.
- Energy is spontaneously transferred out of hotter regions or objects and into colder ones.
- The transfer of energy can be tracked as energy flows through a designed or natural system.
- The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful.
- Specification of constraints includes consideration of scientific principles and other relevant knowledge that is likely to limit possible solutions.
- A solution needs to be tested and then modified on the basis of the test results in order to improve it.
- There are systematic processes for evaluating solutions with respect to how well they meet criteria and constraints of a problem

Students will be able to...

- Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample
- Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.
- Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

EVIDENCE OF LEARNING

Assessment:

What evidence will be collected and deemed acceptable to show that students truly "understand"?

- **End of Unit Assessment**:
    - Students will individually and collaboratively plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of particles as measured by the temperature of the sample.

- Students will be able to design criteria and constraints for a device that either minimizes or maximizes thermal energy transfer

Learning Activities:

What differentiated learning experiences and instruction will enable all students to achieve the desired results?

- Students could create and investigate a density layering of salt solutions.
- Students could examine how the mass of ice cubes added to the beverage affects the temperature change.
- Students might investigate how the mass of the can of soda affects the temperature change as it sits on the table after being removed from the refrigerator. (Examples of experiments could include a comparison of final temperatures after different masses of ice have melted in the same volume of water with the same initial temperature, the temperature change of samples of different materials as they cool or heat in the environment, or the same material with different masses when a specific amount of thermal energy is added. dents will move into the engineering process to solve a problem using this content)
- Students could combine the concepts of thermal energy and engineering processes to design, construct, and test a device that either minimizes or maximizes thermal energy transfer. (Examples of devices could include an insulated box, a solar cooker, or a Styrofoam cup. Calculation of the total amount of thermal energy is not to be assessed at this time)
- Students will design and test a device to control the transfer of thermal energy into or out of the system they studied.
- Students could conduct short research projects to examine factors such as societal and individual needs, cost effectiveness, available materials and natural resources, current scientific knowledge, and current advancements in science and technology.

RESOURCES

Teacher Resources:

- **FOSS Module**- Weather and Water- FOSS website Investigations 4 and 5
- **Mosa Mack-** Mosa Mack Thermal Energy: In Mosa Mack's Thermal Energy unit students solve two mysteries on thermal energy that demonstrate that heat is a form of energy that moves from areas of high heat to low heat. Students are hired by the Better Business Bureau to put their knowledge of heat
- States of Matter: Watch different types of molecules form a solid, liquid, or gas. Add or remove heat and watch the phase change. Change the temperature or volume of a container and see a pressure-temperature diagram respond in real time. Relate the interaction potential to the forces between molecules.
- Energy Forms and Changes Explore how heating and cooling iron, brick, and water adds or removes energy. See how energy is transferred between objects. Build your own system, with energy sources, changers, and users. Track and visualize how energy flows and changes through your system

- **Nearpod**:Nearpod Link *Heat Transfer Conduction*
- **Brainpop**: https://www.brainpop.com *Heat Transfer*
- **EdPuzzle:** https://edpuzzle.com/ Various videos

Equipment Needed:

- Projector with Computer, Whiteboard and High speed internet
- Laboratory equipment as specified for unit
- Online access to FOSS modules (Weather and Water)
- Online access to Mosa Mack platform
- Online access to Nearpod platform
- Online access to PHET simulation
- Online access to BrainPop
- Online access to EdPuzzle

UNIT 3 OVERVIEW

Content Area: Physical Science

Unit Title: Waves/The Electromagnetic Spectrum

Target Course/Grade Level: 6th

Unit Summary: In this unit of study, students *develop and use models, use mathematical thinking*, and *obtain, evaluate, and communicate information* in order to describe and predict characteristic properties and behaviors of waves. Students also apply their understanding of waves as a means of sending digital information. The crosscutting concepts of *pattern*s and s*tructure and function* are used as organizing concepts for these disciplinary core ideas.

Approximate Length of Unit: 8 weeks

LEARNING TARGETS

NJ Student Learning Standards:

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

Interdisciplinary Connections and Standards:
Career Readiness, Life Literacies, and Key Skills:

9.4.8.CI.1: Assess data gathered on varying perspectives on causes of climate change (e.g., cross cultural,
gender-specific, generational), and determine how the data can best be used to design multiple potential solutions.

9.4.8.CT.1: Evaluate diverse solutions proposed by a variety of individuals, organizations, and/or agencies to a
local or global problem, such as climate change, and use critical thinking skills to predict which one(s) are likely
to be effective (e.g., MS-ETS1-2).

9.4.8.CT.2: Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the
most plausible option.

9.4.8.GCA.2: Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a

group goal.
9.4.8.IML.1: Critically curate multiple resources to assess the credibility of sources when searching for information.
9.4.8.IML.3: Create a digital visualization that effectively communicates a data set using formatting techniques such as form, position, size, color, movement, and spatial grouping.
9.4.8.IML.4: Ask insightful questions to organize different types of data and create meaningful visualizations.
9.4.8.IML.12: Use relevant tools to produce, publish, and deliver information supported with evidence for an authentic audience.
9.4.8.TL.1: Construct a spreadsheet in order to analyze multiple data sets, identify relationships, and facilitate data-based decision-making.
9.4.8.TL.2: Gather data and digitally represent information to communicate a real-world problem (e.g., MS-ESS3-4, 6.1.8.EconET.1, 6.1.8.CivicsPR.4).
9.4.8.TL.3: Select appropriate tools to organize and present information digitally.
9.4.8.TL.4: Synthesize and publish information about a local or global issue or event.

Interdisciplinary Connections and Standards:
Mathematics:
MP.2 Reason abstractly and quantitatively.
MP.4 Model with mathematics.
6.RP.A.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.
6.RP.A.3 Use ratio and rate reasoning to solve real-world and mathematical problems.
7.RP.A.2 Recognize and represent proportional relationships between quantities.
8.F.A.3 Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear.

NJ SLS Companion Standards: Reading and Writing Standards for History, Social Studies, Science, and Technical Subjects:
RST.6-8.1. Cite specific textual evidence to support analysis of science and technical texts.
RST.6-8.2. Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.
RST.6-8.3. Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
RST.6-8.7. Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).
NJSLSA.W1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
NJSLSA.W6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.
NJSLSA.W7. Conduct short as well as more sustained research projects, utilizing an inquiry-based research process, based on focused questions, demonstrating understanding of the subject under investigation.
WHST.6-8.1. Write arguments focused on discipline-specific content.

A. Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.
B. Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.
C. Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.
D. Establish and maintain a formal/academic style, approach, and form.
E. Provide a concluding statement or section that follows from and supports the argument presented.

Unit Understandings:

Students will understand that…

- A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude.
- Describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.
- Graphs and charts can be used to identify patterns in data.
- Waves can be described with both qualitative and quantitative thinking.
- When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency (color) of the light.
- The path that light travels can be traced as straight lines, except at surfaces between different transparent materials (e.g., air and water, air and glass) where the light path bends.
- A wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media.
- Waves are reflected, absorbed, or transmitted through various materials.
- A sound wave needs a medium through which it is transmitted.
- Because light can travel through space, it cannot be a matter wave, like sound or water waves.
- The structure of a wave can be modified to serve particular functions by taking into account properties of different materials and how materials can be shaped and used.
- When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency (color) of the light.
- The path that light travels can be traced as straight lines, except at surfaces between different transparent materials (e.g., air and water, air and glass) where the light path bends.
- A wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media.
- Waves are reflected, absorbed, or transmitted through various materials.
- A sound wave needs a medium through which it is transmitted.
- Because light can travel through space, it cannot be a matter wave, like sound or water waves.
- The structure of a wave can be modified to serve particular functions by taking into account properties of different materials and how materials can be shaped and used.

Unit Essential Questions:

- Why do surfers love physicists?
- How do the light and sound system in the auditorium work?
- If rotary phones worked for my grandparents, why did they invent cell phones?

Knowledge and Skills:

Students will know...

- Waves are a means of sending digital information.
- The physical properties of waves
- How waves move through different materials

Students will be able to...

- Use mathematical representations to describe and/or support scientific conclusions about how the amplitude of a wave is related to the energy in a wave.
- Use mathematical representations to describe a simple model.
- Develop and use models to describe the movement of waves in various materials.
- Integrate qualitative scientific and technical information in written text with that contained in media and visual displays to clarify claims that digitized signals are a more reliable way to encode and transmit information than analog signals are.

EVIDENCE OF LEARNING

Assessment:

What evidence will be collected and deemed acceptable to show that students truly "understand"?

- **End of Unit Assessment**:
  - Students will be able to develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.
  - Students will be able to describe and predict characteristic properties and behaviors of waves and apply their understanding of waves by sending digital information.

Learning Activities:

What differentiated learning experiences and instruction will enable all students to achieve the desired results?

- Students will collect pulse data to provide evidence that waves have repeating patterns.
- Students will model waves by creating transverse and standing waves
- Learn about mechanical waves by viewing Big Waves video from FOSS.web.com and answering discussion questions.
- Collect data to about angle of reflection to develop the law of reflection
- Students will use color filters to make inferences about wavelengths of light and the color of objects
- Conduct investigations to explore what happens to light waves at the interface between different media to provide evidence of refraction and internal reflection
- Learn about how information is encoded and sent as digital waves to transfer large amounts of information over large distances

RESOURCES

Teacher Resources:

- **FOSS Module**- Waves- FOSS website Investigations 1-4
- **Mosa Mack-** Mosa Mack Waves: In this unit students solve a mystery involving waves, explore light and sound through hands-on stations, and then apply their knowledge of waves to engineer a new device to help individuals with hearing or vision impairments
- PhET-Waves on a String and Sound Waves
- **Nearpod**:Nearpod Link *Catch a Wave, Waves on a String, and Light Waves*
- **Brainpop**: https://www.brainpop.com *Waves, Sound, and Light*
- **EdPuzzle:** https://edpuzzle.com/ Various videos

Equipment Needed:

- Projector with Computer, Whiteboard and High speed internet
- Laboratory equipment as specified for unit
- Online access to FOSS modules (Waves)
- Online access to Mosa Mack platform
- Online access to Nearpod platform
- Online access to PHET simulation
- Online access to BrainPop
- Online access to EdPuzzle

UNIT 4 OVERVIEW

Content Area: Earth and Space Science

Unit Title: Astronomy

Target Course/Grade Level: 6th Grade

Unit Summary:

In this unit, students ask questions, plan and carry out investigations, engage in argument from evidence, analyze and interpret data, construct explanations, define problems and design solutions as they make sense of the difference between energy and temperature. They use the practices to make sense of how the total change of energy in any system is always equal to the total energy transferred into or out of the system. The crosscutting concepts of energy and matter, scale, proportion, and quantity, and influence of science, engineering, and technology on society and the natural world are the organizing concepts for these disciplinary core ideas. Students ask questions, plan and carry out investigations, engage in argument from evidence, analyze and interpret data, construct explanations, define problems and design solutions. Students are also expected to use these practices to demonstrate understanding of the core ideas.

Approximate Length of Unit: 8 Weeks

LEARNING TARGETS

NJ Student Learning Standards:

MS-PS3-3: Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.

MS-PS3-4: Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.

MS-ETS1-1: Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

MS-ETS1-2: Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS1-3:3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

MS-ETS1-4: Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved

Interdisciplinary Connections and Standards:
Career Readiness, Life Literacies, and Key Skills:

9.4.8.CI.1: Assess data gathered on varying perspectives on causes of climate change (e.g., cross cultural, gender-specific, generational), and determine how the data can best be used to design multiple potential solutions.

9.4.8.CT.1: Evaluate diverse solutions proposed by a variety of individuals, organizations, and/or agencies to a local or global problem, such as climate change, and use critical thinking skills to predict which one(s) are likely to be effective (e.g., MS-ETS1-2).

9.4.8.CT.2: Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option.

9.4.8.GCA.2: Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a group goal.

9.4.8.IML.1: Critically curate multiple resources to assess the credibility of sources when searching for information.

9.4.8.IML.3: Create a digital visualization that effectively communicates a data set using formatting techniques such as form, position, size, color, movement, and spatial grouping.

9.4.8.IML.4: Ask insightful questions to organize different types of data and create meaningful visualizations.

9.4.8.IML.12: Use relevant tools to produce, publish, and deliver information supported with evidence for an authentic audience.

9.4.8.TL.1: Construct a spreadsheet in order to analyze multiple data sets, identify relationships, and facilitate data-based decision-making.

9.4.8.TL.2: Gather data and digitally represent information to communicate a real-world problem (e.g., MS-ESS3-4, 6.1.8.EconET.1, 6.1.8.CivicsPR.4).

9.4.8.TL.3: Select appropriate tools to organize and present information digitally.

9.4.8.TL.4: Synthesize and publish information about a local or global issue or event.

Interdisciplinary Connections and Standards:
Mathematics

MP.2: Reason abstractly and quantitatively. (MS-ESS1-3)

MP.4: Model with mathematics. (MS-ESS1-1),(MS-ESS1-2) MP.4

6.RP.A.1: Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. (MS-ESS1-1),(MS-ESS1-2),(MS-ESS1-3)

7.RP.A.2: Recognize and represent proportional relationships between quantities. (MS-ESS1-1),(MS-ESS1-2),(MS-ESS1-3)

6.EE.B.6: Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set(MS-ESS1-2)

7.EE.B.6: Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. (MS-ESS1-2)

NJ SLS Companion Standards: Reading and Writing Standards for History, Social Studies, Science, and Technical Subjects:

RST.6-8.1. Cite specific textual evidence to support analysis of science and technical texts.

RST.6-8.2. Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.

RST.6-8.3. Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

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

NJSLSA.W1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

NJSLSA.W6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

NJSLSA.W7. Conduct short as well as more sustained research projects, utilizing an inquiry-based research process, based on focused questions, demonstrating understanding of the subject under investigation.

WHST.6-8.1. Write arguments focused on discipline-specific content.

A. Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.

B. Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.

C. Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.

D. Establish and maintain a formal/academic style, approach, and form.

E. Provide a concluding statement or section that follows from and supports the argument presented.

Unit Understandings:

Students will understand that…

- Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models. (MS-ESS1-1)
- Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe. (MS-ESS1-2)
- The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them. (MS-ESS1-2),(MS-ESS1-3)
- This model of the solar system can explain eclipses of the sun and the moon. Earth's spin axis is fixed in direction over the short-term but tilted relative to its orbit around the sun. The seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year. (MS-ESS1-1)
- The solar system appears to have formed from a disk of dust and gas, drawn together by gravity. (MS-ESS1-2)

Unit Essential Questions:

- What are the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons?
- What is the role of gravity in the motions within galaxies and the solar system?
- How do we determine the scale properties of objects in space?

Knowledge and Skills:

Students will know...

- Patterns in the apparent motion of the sun, moon, and stars in the sky can be observed, described, predicted, and explained with models.
- The Earth and solar system model of the solar system can explain eclipses of the sun and the moon.
- Earth's spin axis is fixed in direction over the short term but tilted relative to its orbit around the sun.
- The seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year.
- Patterns can be used to identify cause-and-effect relationships that exist in the apparent motion of the sun, moon, and stars in the sky.
- Science assumes that objects and events in the solar system systems occur in consistent patterns that are understandable through measurement and observation.
- Gravity plays a role in the motions within galaxies and the solar system.
- Gravity is the force that holds together the solar system and Milky Way galaxy and controls orbital motions within them.
- Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe.
- The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids, that are held in orbit around the sun by its gravitational pull on them.
- Objects in the solar system have scale properties.
- Data from Earth-based instruments, space-based telescopes, and spacecraft can be used to determine similarities and differences among solar system objects.
- The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them.
- Time, space, and energy phenomena in the solar system can be observed at various scales, using models to study systems that are too large.
- Engineering advances have led to important discoveries in space science, and scientific discoveries have led to the development of entire industries and engineered systems.

Students will be able to...

- Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.
- Analyze and interpret data to determine scale properties of objects in the solar system.
- Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.

EVIDENCE OF LEARNING

Assessment:

What evidence will be collected and deemed acceptable to show that students truly "understand"?

- **End of Unit Assessment**:
  - Students will develop and use a physical, graphical, or conceptual model to describe patterns in the apparent motion of the sun, moon, and stars in the sky.
  - Students will develop and use a physical, graphical, or conceptual model to describe patterns in the apparent motion of the sun, moon, and stars in the sky.

Learning Activities:

What differentiated learning experiences and instruction will enable all students to achieve the desired results?

- Students will develop and use mathematical, physical, graphical or conceptual models to describe the cyclical patterns of lunar phases, eclipses of the sun and moon, and seasons.
- Students will explore, through the development and use of models, the role of the force of gravity in explaining the motions within our solar system and the Milky Way Galaxy. Students will use mathematical models or simulations that show the relationship between relative sizes of objects in the solar system and the size of the gravitational force that is being exerted on the object. Tobject if it were on the surface of different-sized planets that have very different masses.
- Students will gather evidence that every object in the solar system is attracted to every other object in the solar system with a force that is related to the mass of the objects and the distance between the objects.
- Students will also analyze and interpret data from Earth-based instruments to determine the scale properties of objects within our solar system.

RESOURCES

Teacher Resources:

- **FOSS Module**- Planetary Science- FOSS website
- **MOSA MACK-** Mosa Mack Sun-Earth Systems (Lessons 2 and 3)
- NASA Solar System Exploration: This link will connect you to NASA's Solar system Exploration website. The website offers a wide variety of student activities.
- Seasons Interactive provides students with the opportunity to investigate how Earth's angle of inclination affects three factors: the angle of incoming sunlight, average daily temperatures and the Sun's ecliptic path. Three preset values for the angle of inclination are available (corresponding to the values of Earth, Venus and Uranus).

- In Eclipse Interactive, students investigate both lunar and solar eclipses by manipulating up to three independent variables: Moon's tilt from orbit, Earth-Moon distance and size of the Moon.
- The Pull of the Planets is part of a thematic series of lessons highlighting the Juno mission to Jupiter. It is a traditional hands-on activity that models how gravitational forces can keep planets and asteroids in orbit within the Solar System.
- **Nearpod**:Nearpod Link *Solar System- Patterns and Movement*
- **Brainpop**: https://www.brainpop.com *Solar System*
- **EdPuzzle:** https://edpuzzle.com/ Various videos

Equipment Needed:

- Projector with Computer, Whiteboard and High speed internet
- Laboratory equipment as specified for unit
- Online access to FOSS modules (Weather and Water)
- Online access to Mosa Mack platform
- Online access to Nearpod platform
- Online access to PHET simulation
- Online access to BrainPop
- Online access to EdPuzzle

UNIT 5 OVERVIEW

Content Area: Life Science

Unit Title: Growth, Development, and Reproduction of Organisms

Target Course/Grade Level: 6th Grade

Unit Summary:

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

Approximate Length of Unit: 8 Weeks

LEARNING TARGETS

NJ Student Learning Standards:

MS-LS1-4: Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

MS-LS1-5.Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

Interdisciplinary Connections and Standards:

Career Readiness, Life Literacies, and Key Skills:

9.4.8.CI.1: Assess data gathered on varying perspectives on causes of climate change (e.g., cross cultural, gender-specific, generational), and determine how the data can best be used to design multiple potential solutions.

9.4.8.CT.1: Evaluate diverse solutions proposed by a variety of individuals, organizations, and/or agencies to a local or global problem, such as climate change, and use critical thinking skills to predict which one(s) are likely to be effective (e.g., MS-ETS1-2).

9.4.8.CT.2: Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option.

9.4.8.GCA.2: Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a group goal.
9.4.8.IML.1: Critically curate multiple resources to assess the credibility of sources when searching for information.
9.4.8.IML.3: Create a digital visualization that effectively communicates a data set using formatting techniques such as form, position, size, color, movement, and spatial grouping.
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9.4.8.IML.12: Use relevant tools to produce, publish, and deliver information supported with evidence for an authentic audience.
9.4.8.TL.1: Construct a spreadsheet in order to analyze multiple data sets, identify relationships, and facilitate data-based decision-making.
9.4.8.TL.2: Gather data and digitally represent information to communicate a real-world problem (e.g., MS-ESS3-4, 6.1.8.EconET.1, 6.1.8.CivicsPR.4).
9.4.8.TL.3: Select appropriate tools to organize and present information digitally.
9.4.8.TL.4: Synthesize and publish information about a local or global issue or event.

Mathematics
6.SP.A.2: Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape. (MS-LS1-4),(MS-LS1-5)
6.SP.B.4: Summarize numerical data sets in relation to their context. (MS-LS1-4),(MS-LS1-5)

NJ SLS Companion Standards: Reading and Writing Standards for History, Social Studies, Science, and Technical Subjects:
RST.6-8.1. Cite specific textual evidence to support analysis of science and technical texts.
RST.6-8.2. Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.
RST.6-8.3. Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
RST.6-8.7. Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).
NJSLSA.W1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
NJSLSA.W6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.
NJSLSA.W7. Conduct short as well as more sustained research projects, utilizing an inquiry-based research process, based on focused questions, demonstrating understanding of the subject under investigation.
WHST.6-8.1. Write arguments focused on discipline-specific content.
A. Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.
B. Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.
C. Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.
D. Establish and maintain a formal/academic style, approach, and form.

E. Provide a concluding statement or section that follows from and supports the argument presented.

Unit Understandings:

Students will understand that…

- Animals engage in characteristic behaviors that increase the odds of reproduction. (MS-LS1-4)
- Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction. (MS-LS1-4)
- Genetic factors as well as local conditions affect the growth of the adult plant. (MS-LS1-5)

Unit Essential Questions:

- How do characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively?
- In what ways do environmental and genetic factors influence the growth of organisms?

Knowledge and Skills:

Students will know...

- Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction.
- There are a variety of ways that plants reproduce.
- Specialized structures for plants affect their probability of successful reproduction.
- Some characteristic animal behaviors affect the probability of successful reproduction in plants.
- There are a variety of characteristic animal behaviors that affect their probability of successful reproduction.
- There are a variety of animal behaviors that attract a mate.
- Successful reproduction of animals and plants may have more than one cause, and some cause-and-effect relationships in systems can only be described using probability.
- Genetic factors as well as local conditions affect the growth of organisms.
- The factors that influence the growth of organisms may have more than one cause.
- Some cause-and-effect relationships in plant and animal systems can only be described using probability.

Students will be able to...

- Use arguments based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.
- Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.

EVIDENCE OF LEARNING

Assessment:

What evidence will be collected and deemed acceptable to show that students truly "understand"?

- **End of Unit Assessment**: Students will be able to support or refute an explanation of how characteristic animal behaviors and specialized plant structures affect the probability of successful plant reproduction using oral and written arguments.

Learning Activities:

What differentiated learning experiences and instruction will enable all students to achieve the desired results?

- Students will use arguments based on empirical evidence and scientific reasoning to support an explanation of how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants.
- Students may observe examples of plant structures that could affect the probability of plant reproduction, including bright flowers attracting butterflies that transfer pollen, flower nectar and odors that attract pollen-transferring insects, and hard shells on nuts that squirrels bury.
- Students may observe examples of animal behaviors that affect the probability of plant reproduction, which could include observing how animals can transfer pollen or seeds and how animals can create conditions for seed germination and growth (e.g., students may conduct an experiment using rapid cycling Brassica rapa [Fast Plant] and collect data on how many plants produce seeds with and without the aid of a pollinator.
- Students could then observe examples of animal behaviors (using videos, Internet resources, books, etc.) that could affect the probability of successful animal reproduction.
- Students can present an oral and/or written argument supported by evidence and scientific reasoning that characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants, respectively.
- Students could examine and explain how environmental conditions and genetic factors affect the growth of an organism.

RESOURCES

Teacher Resources:

- **FOSS Module**- Diversity of Life- FOSS website Investigation 6
- **MOSA MACK**- Mosa Mack Genetic Variation. In this unit about genetic variation, learners help Mosa solve the mystery of why some organisms have identical offspring and others have offspring that exhibit variation. Through the mystery as well as a hands-

on modeling
- Plant Reproduction Lesson Plant Reproduction
- **Nearpod**: *Is it Alive?, Reproduction, and Ensuring Survival*
- **BrainPop**:*Cell Structures, Sexual Reproduction, and Heredity*
- **EdPuzzle:** Various videos

Equipment Needed:

- Projector with Computer, Whiteboard and High speed internet
- Laboratory equipment as specified for unit
- Online access to FOSS modules (Weather and Water)
- Online access to Mosa Mack platform
- Online access to Nearpod platform
- Online access to BrainPop
- Online access to EdPuzzle