MEDFORD LAKES SCHOOL DISTRICT

Science Curriculum Guide

3rd Grade

Written by: Jenn York

Approved by the Board of Education August 16, 2017

(Aligned with 2016 New Jersey Student Learning Standards for Science)

Medford Lakes Board of Education

Sandra Weiss, President
Robert Brittain, Vice President
Kim Bezanis
Kristen Caputo
Mary Sullivan

Administration

Anthony V. Dent, Superintendent/Neeta School Principal
Michael Colling, Business Administrator
Carole M. Ramage, Director of Curriculum/Nokomis School Principal
Paulette Bearer, Interim Supervisor of Special Services/Child Study Team
Greg Witham, Supervisor of Buildings and Grounds

Table of Contents

Science Philosophy Statement

The goal of the Medford Lakes School District's science program/curriculum is to produce students who have gained sufficient knowledge of the practices, crosscutting concepts, and core ideas of science and engineering to engage in public discussions on science-related issues, to be critical consumers of scientific information related to their everyday lives, and to continue to learn about science throughout their lives. They should come to appreciate that science and the current scientific understanding of the world are the result of many hundreds of years of creative human endeavor.

Given this goal, an integrated science curriculum model should drive the formation of science curriculum because:

- *The nature of science is complex and multidisciplinary.*
- *Learning theory research in science shows expert knowledge base develops better through interdisciplinary connections and not through isolated content.*
- *Effective research-based practices for curriculum and instruction in science and engineering are supported through this approach.*

Nature of Science

The nature of science is complex and multidisciplinary. From research about how scientists work, we know that scientists do not work in isolation in their own house of physics, or biology or chemistry but they reach out and create networks of scientists within and across disciplines who can contribute understanding, share ideas, and critique evidence and explanations. As we see in the science of global climate change, scientists work across the fields of geology, physics, and biology to provide evidence, plan investigations, and develop models to represent new ways to think about Earth systems. Important practices like engaging in argument from evidence, modeling, and communicating information do not occur in isolation but rely on feedback from within and across scientific communities and disciplines. Basing the district's curriculum in an integrated model where the students are engaged with a variety of topics at each grade, focused on the connection of ideas across the domains, enhances the interdisciplinary nature of science.

Learning Theory

In the elementary years, students build their understandings of core concepts across all domains of science. Continuing this model in grades 6-8 better supports student learning in that there will not be a large gap of time in which a student does not engage in a specific discipline. This model takes advantage of current research which recognizes that there is variation across children at a given age and that thinking does not develop along a preset roadmap for each student. It allows middle school students to build on what they know and think they understand from their elementary years with the goal in middle school of helping students to revise their knowledge and understanding about those core ideas. Learning theory research shows expert knowledge base develops better through interdisciplinary real-world connections then through isolated content. This is especially important in middle school where motivation is critical to learning. An integrated and better articulated middle school model science curriculum that reflects what we know currently about how children learn science and how their mastery develops over time promotes deeper learning in science. As we know and understand about how students develop understanding while learning content, it informs teachers' practice; if teachers understand where their students are in their understanding of core ideas, and anticipate what students' misconceptions and struggles may be, they are better able to differentiate instruction and provide scaffolding that allows students to develop an integrated and deeper understanding of the science.

Research Based Science Instruction and Curriculum

Effective science instruction can take many forms but includes similar components. According to the Center on Instruction's 2010 report, *Effective Science Instruction: What does the Research Tell Us?*, research-based effective practices of curriculum and instruction important to science learning are: Motivation, Eliciting Students' Prior Knowledge, Intellectual Engagement; Use of Evidence to Critique Claims, and Sense-Making. The integrated model may be better able to support some of these instructional practices especially if it frames curriculum around engaging, relevant, and real-world interdisciplinary questions that will increase student motivation, intellectual engagement and sense-making. Effective science instruction helps middle school students build their understandings and practices, makes connections among and between core concepts and practices, and links to their prior knowledge. Students in grades 6-8 come to understand the natural world in a more scientifically accurate way and understand the nature of science.

Conclusion

Science curriculum should be thematic with a focus on connections among and between core concepts and practices. This approach reinforces the interdisciplinary nature of science and allows for a sequential progression of skills and concepts. This supports developmentally appropriate teaching and assessments. Each grade level has its own specific standards from each science domain that are seen as stepping stones in the progression of learning about a core idea and that meet a specific level of understanding.

Module #	Module Title	# of Core Lessons	Resources/Instructional Materials	Pacing
#1	*"Weather and Climate"*	**6**	Carolina Biological's Building Blocks of Science (2015) *"Weather & Climate Patterns"*	6-7 weeks
#2	*"Forces and Interactions"*	**5**	Carolina Biological's Building Blocks of Science (2015) *"Forces and Interactions"*	6-7 weeks
#3	*"Traits and Continuing the Life Cycle"*	**7**	TCI's Science Alive! (2015) Grade 4 *"Unit #4 Life Cycles and Traits"*	6-7 weeks
#4	*"Organisms and Their Environment"*	**5**	Carolina Biological's Building Blocks of Science (2015) *"Life in Ecosystems"*	6-7 weeks

Grading Expectations Per Trimester	
Classwork	✓ minimum of 15 and maximum of 20
Homework	✓ minimum of 8 and maximum of 10
Quizzes	✓ minimum of 5 and maximum of 7
Tests/Assessment Task	✓ 1-2 per module

Module #1 "Weather and Climate" *(CBBS – "Weather & Climate")*

What is the typical weather near our home?

How can we protect people from weather-related hazards?

In this unit of study, students organize and use data to describe typical weather conditions expected during a particular season. By applying their understanding of weather-related hazards, students are able to make a claim about the merit of a design solution that reduces the impacts of such hazards. The crosscutting concepts of *patterns, cause and effect,* and the *influence of engineering, technology, and science on society and the natural world* are called out as organizing concepts for these disciplinary core ideas. Students demonstrate grade-appropriate proficiency in a*sking questions and defining problems, analyzing and interpreting data, engaging in argument from evidence,* and *obtaining, evaluating, and communicating information*. Students are also expected to use these practices to demonstrate understanding of the core ideas.

This unit is based on 3-ESS2-1, 3-ESS2-2, 3-ESS3-1, and 3-5-ETS1-1.

New Jersey Student Learning Standards/Student Learning Objectives

Develop a model using an analogy, to describe how weather and climate are related. (ESS2.D) *[Note: This SLO is based on the disciplinary core ideas found in the Framework. It is intended to serve as a scaffold to 3-ESS2-1.]*

Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season. *[Clarification Statement: Examples of data could include average temperature, precipitation, and wind direction.] [Assessment Boundary: Assessment of graphical displays is limited to pictographs and bar graphs. Assessment does not include climate change.]* **(3-ESS2-1)**

Obtain and combine information to describe climates in different regions of the world. (3-ESS2-2)

Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard. *[Clarification Statement: Examples of design solutions to weather-related hazards could include barriers to prevent flooding, wind resistant roofs, and lightning rods.]* **(3-ESS3-1)**

Benchmark Assessment:

"Summative Assessment" TG Appendix ___ pg. _____

Unit Sequence	
Part A: *Can we predict the kind of weather that we will see in the spring, summer, autumn, or winter?*	
Concepts	**Formative Assessment**
• Patterns of change can be used to make predictions. • People record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next.	*Students who understand the concepts can:* ✓ Make predictions using patterns of change. ✓ Represent data in tables, bar graphs, and pictographs to reveal patterns that indicate relationships. ✓ Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season. *(Assessment of graphical displays is limited to pictographs and bar graphs. Assessment does not include climate change.)* Examples of data could include: ✓ Average temperature ✓ Precipitation ✓ Wind direction

Unit Sequence	
Part B: *How can climates in different regions of the world be described?*	
Concepts	**Formative Assessment**
• Patterns of change can be used to make predictions. • Climate describes the range of an area's typical weather conditions and the extent to which those conditions vary over years.	*Students who understand the concepts can:* • Make predictions using patterns of change. • Obtain and combine information from books and other reliable media to explain phenomena.

Unit Sequence	
Part C: *How can we protect people from natural hazards such as flooding, fast wind, or lightening?*	
Concepts	**Formative Assessment**
• Cause-and-effect relationships are routinely identified, tested, and used to explain change. • Science affects everyday life. • People's needs and wants change over time, as do their demands for new and improved technologies. • A variety of natural hazards result from natural processes (e.g., *flooding, fast wind, or lightening).* • Humans cannot eliminate natural hazards but can take steps to reduce their impacts. • Engineers improve technologies or develop new ones to increase their benefits (e.g., better artificial limbs), decrease known risks (e.g., seatbelts in cars), and meet societal demands (e.g., cell phones). • Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). • Different proposals for solutions can be compared on the basis of how well each one meets the criteria for success or how well each takes the constraints into account.	*Students who understand the concepts can:* • Identify and test cause-and-effect relationships to explain change. • Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem. • Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard. Examples of design solutions to weather-related hazards could include: ✓ Barriers to prevent flooding ✓ Wind-resistant roofs ✓ Lightning rods • Define a simple design problem that can be solved through the development of an object, tool, process, or system and include several criteria for success and constraints on materials, time, or cost. • Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

What It Looks Like in the Classroom

In this unit of study, students organize and use data to describe typical weather conditions expected during a particular season. They notice patterns as they analyze and interpret weather data, and they use this data to determine cause-and-effect relationships. By applying their understanding of weather-related hazards, students make claims about the merit of a design solution that reduces the impacts of such hazards, using evidence to support their claims.

Initially, students learn that scientists record patterns of weather across different times and locations in order to make predictions about future weather conditions. To understand how scientists use weather data, students need time, tools, and resources (both print and digital) to collect weather data. They can use a variety of tools (e.g., thermometers, anemometers, rain gauges) to collect firsthand data and multiple resources (e.g., Weather Bug, NOAA) to gather weather data that has been collected over longer periods of time. Multiple units of measurement (e.g., m, cm, °C, km/hr) should be used when recording weather conditions such as temperature, types and amounts of precipitation, and wind direction and speed. To organize the data they collect, students create graphical displays (bar graphs and pictographs) and tables. Once a sufficient amount of data is collected, students need opportunities to analyze data, looking for patterns of change that can be used to make predictions about typical weather conditions for a particular region and time of year. As they collect and analyze data over time, students learn that certain types of weather tend to occur in a given area and that combinations of weather conditions lead to certain types of weather (e.g., it is always cloudy when it rains or snows, but not all types of clouds bring precipitation).

Weather is a combination of sunlight, wind, precipitation, and temperature in a particular region at a particular time. Climate describes the range of an area's typical weather conditions and the extent to which those conditions vary over the years. After learning to analyze and use data to make weather predictions, students use long-term patterns in weather to describe climates in a variety of regions around the world. To accomplish this, students use books and other reliable media to obtain information and weather data collected over a long period of time for a variety of regions. With guidance, students analyze the available data and information in order to describe the climate (e.g., average temperatures, average precipitation, average amount of sunlight) in each region.

Science affects everyday life. Whenever people encounter problems, engineers use scientific knowledge to develop new technologies or improve existing ones to solve our day-to-day problems.

After studying weather and climate, students investigate how weather-related hazards can be reduced. Students learn that there are a variety of natural hazards that result from severe weather. Severe weather, such as high winds, flooding, severe thunderstorms, tornados, hurricanes, ice or snowstorms, dust storms, or drought, has the potential to disrupt normal day-to-day routines and cause damage or even loss of life. While humans cannot eliminate natural hazards, they can take steps to reduce their impact. Students can use trade books and media resources to research types of severe weather hazards and their effects on communities and find examples of how communities solve problems caused by severe weather. As a class, students determine the types of severe weather that are common to the local area and discuss the effects on the community. (Define the problem.) In pairs or small groups, students can research ways that the community

reduces the effects of severe weather. (Determine ways in which the problem is solved.) Given criteria, groups can determine how well each solution reduces the effects of severe weather. Groups can also prepare a presentation that

- Describes the solution that the group thinks is best for reducing the effects of a given type of weather hazard,
- Lists evidence to support their thinking, and

  Lists at least one possible constraint, such as materials, time, or cost.

Connecting with English Language Arts/Literacy and Mathematics
English Language Arts/Literacy As students engage in the science described in this unit of study, they use books and other reliable media resources to collect weather and climate information for a given region. They compare information found in two different texts and use information to answer questions about weather and climate. To integrate writing, students can take brief notes as they conduct research and sort evidence into provided categories. Opinion pieces and short research projects should be included to build knowledge about weather and climate. *Mathematic* Like literacy, mathematics is integrated in a variety of ways. Students use appropriate tools and units of measure when collecting and recording weather and climate data. They model with mathematics when organizing data into scaled bar graphs, pictographs, and tables. Throughout the unit, students reason abstractly and quantitatively as they analyze and compare weather data. They will use that information to answer questions and solve multistep problems.

Modifications	
Special Education: • Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community. • Provide students with multiple choices for how they can represent their understandings (e.g. multi-sensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling). • Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies). • Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences). • Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings. • Teacher models • Show additional number of samples/examples • Provide additional opportunities to practice • Use re-teaching and/or restating to address student's needs • Use small group table conferences to address needs • Develop target vocabulary • Scaffold comprehension when reading is necessary to fully understand science concept(s) • Use graphic organizers to develop key concepts/ideas • Teach key aspects of a topic and eliminate nonessential information.	**English Language Learners (ELLs):** • Model Thinking Aloud • Encourage Partner Talk • Repeat and Clarify • Provide a Sequence • Encourage self-selection of topics • Target vocabulary • Scaffold comprehension when reading is used to promote reader response • Scaffold content-literacy reading • Allow products to demonstrate student's learning • Provide on-going feedback

Students at Risk of School Failure:	**Gifted Students:**
● Build a relationship ● Allow flexible due dates ● Employ strategies from *"Classroom Instruction that Works"* ● Create the Opportunity to Learn strategies ● Build lessons around student interests	• Utilize flexible groups-group gifted students with other gifted students or higher-level learners • Encourage students to explore/research concepts in depth via independent studies or investigations (individual/group) • Differentiate product assignments. Employ differentiated curriculum to keep interest/motivation high • Encourage creative expression and thinking by allowing students to choose how to approach a problem or assignment (problem based learning) • Invite students to explore different points of view on a topic of study and compare the two • Provide multiple opportunities for students to "Own Their Learning" • Ask students higher-level questions that require students to look into causes, experiences, and facts to draw a conclusion to other areas of learning. (Webb's Depth of Knowledge- Level 4) • Create a room environment that encourages creativity and discovery through the use of interesting literature and reference materials. Supply reading materials on a wide variety of subjects and levels • Provide a learning-rich environment that includes a variety of resources, media, tasks, and methods of teaching

Prior Learning

Kindergarten Unit 3: Weather

- Weather is the combination of sunlight, wind, snow or rain, and temperature in a particular region at a particular time. People measure these conditions to describe and record the weather and to notice patterns over time.
- Some kinds of severe weather are more likely than others in a given region. Weather scientists forecast severe weather so that the communities can prepare for and respond to these events.
- Asking questions, making observations, and gathering information are helpful in thinking about problems. *(secondary)*

Future Learning

Grade 4 Unit 1: Weathering and Erosion

- Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around.

Grade 4 Unit 5: Transfer of Energy

- A variety of hazards result from natural processes (e.g., earthquakes, tsunamis, volcanic eruptions). Humans cannot eliminate the hazards but can take steps to reduce their impacts.

Grade 4 Unit 7: Using Engineering Design with Force and Motion Systems

- Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. *(secondary)*

Appendix A: NGSS and Foundations for the Module		
Develop a model using an analogy, to describe how weather and climate are related. (ESS2.D) *[Note: This SLO is based on the disciplinary core ideas found in the Framework. It is intended to serve as a scaffold to 3-ESS2-1.]*		
Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season. *[Clarification Statement: Examples of data could include average temperature, precipitation, and wind direction.] [Assessment Boundary: Assessment of graphical displays is limited to pictographs and bar graphs. Assessment does not include climate change.]* **(3-ESS2-1)**		
Obtain and combine information to describe climates in different regions of the world. (3-ESS2-2)		
Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard. *[Clarification Statement: Examples of design solutions to weather-related hazards could include barriers to prevent flooding, wind resistant roofs, and lightning rods.]* **(3-ESS3-1)**		
The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:		
Science and Engineering Practices	**Disciplinary Core Ideas**	**Crosscutting Concepts**
Planning and Carrying Out Investigations • Plan and conduct investigations collaboratively to produce evidence to answer a question. (1-PS4-1),(2-LS2-1) **Analyzing and Interpreting Data** • Represent data in tables and various graphical displays (bar graphs and pictographs) to reveal patterns that indicate relationships. (3-ESS2-1) **Engaging in Argument from Evidence** • Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria	**ESS2.D: Weather and Climate** • Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next. (3-ESS2-1) • Climate describes a range of an area's typical weather conditions and the extent to which those conditions vary over years. (3-ESS2-2) **ESS3.B: Natural Hazards** • A variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take	**Patterns** • Patterns of change can be used to make predictions. (3-ESS2-1),(3-ESS2-2) **Cause and Effect** • Cause and effect relationships are routinely identified, tested, and used to explain change. (3-ESS3-1) --- ***Connections to Engineering, Technology, and Applications of Science*** **Influence of Engineering, Technology, and Science on Society and the Natural World**

and constraints of the problem. (3-ESS3-1) **Obtaining, Evaluating, and Communicating Information** • Obtain and combine information from books and other reliable media to explain phenomena. (3-ESS2-2)	steps to reduce their impacts. (3-ESS3-1) *(Note: This Disciplinary Core Idea is also addressed by 4-ESS3-2.)*	• Engineers improve existing technologies or develop new ones to increase their benefits (e.g., better artificial limbs), decrease known risks (e.g., seatbelts in cars), and meet societal demands (e.g., cell phones). (3-ESS3-1) --- ***Connections to Nature of Science*** **Science is a Human Endeavor** • Science affects everyday life. (3-ESS3-1)

Module #1 "Weather and Climate" *(CBBS "Weather and Climate Kit")*
Core Lesson #1 *"What is Weather?"*

Essential Question(s):

- What is weather?
- What are ways to measure aspects of the weather?

Objectives	NJSLS Standard(s)	Segment	Time	Instructional Plan/Materials
SWBAT: • Make observations about the weather • Interpret weather clues • Investigate tools that measure rainfall, wind, and temperature	3.ESS2.1 3.ESS2.D L.3.4 L3.5 L.3.6 RI.3.1 RI.3.3 SL.3.1 W.3.2 W.3.10 3.MD.A.2 3.MD.B.4 3.NBT.A.1 3.NBT.A.2	*Introduction/ Anticipatory Set*	- one 30 minute class period	**Part A:** "Pre-Unit Assessment: "What Do We Know About Weather?" TG pg. 3 • Follow Activity Instructions for Part A (TG pgs. 3-4) • Distribute Student Activity Sheet 1A "How Was the Weather?" and discuss same– one for each student • Notebook Prompt TG pg. 4 "Write two things you know about the weather"
		Activity	- one 30 minute class period	**Part B:** "For Good Measure" TG pgs. 4-6 • Follow Activity Instructions for Part B (TG pgs. 7-9) • Divide class into small groups and distribute a thermometer – one per group • Distribute Student Activity Sheet 1B "Measuring the Weather" TG pg.5 – one per student • Engage in a discussion about the

				instruments people use to measure aspects of the weather TG pg.6 • Notebook Opportunity TG pg. 6 "Name three instruments meteorologist use to study the weather."
		Evaluation/ Assessment	- one 30 minute class period	**Part C:** "Studying and Forecasting" TG pg. 6 • Follow Activity Instructions for Part C (TG pgs. 6-7) • Tell students that one thing meteorologists do is study past weather. • Distribute Student Activity Sheet 1C "Last Year's Weather" – one per student • Notebook Opportunity TG pg. 7 "What is weather? What are some different parts of the weather?" • Possible "Extensions" TG pg. 8 • Read pgs. 2,3, & 8"Climate and Weather Patterns" Literacy Series Reader (See Appendix E in TG) • Take-Home Science TG pg. 7
Key Vocabulary: • Celsius • Degrees • Direction				

- Fahrenheit
- Forecast
- Meteorologist
- Meteorology
- Precipitation
- Rain
- Rain gauge
- Rainfall
- Temperature
- Thermometer
- Weather
- Wind vane

Module #1 "Weather and Climate" *(CBBS "Weather and Climate Kit")*
Core Lesson #2 *"Weather Data"*

Essential Question(s):

- What tools do meteorologists use to predict weather patterns?
- What is the purpose of measuring precipitation?

Objectives	NJSLS Standard(s)	Segment	Time	Instructional Plan/Materials
SWBAT: • Learn the mathematical formula for averages • Determine the daily and weekly averages for temperature in an area • Use media resources to determine local precipitation amounts • Craft a newscast to deliver weather reports to fellow classmates	3.ESS2.1 3.ESS2.D L.3.4 L.3.6 RI.3.5 RI.3.7 SL.3.1 SL.3.2 W.3.2 W.3.10 3.MD.A.2 3.MD.B.3 3.NBT.A.1 3.NBT.A.2	*Introduction/ Anticipatory Set*	- one 30 minute class period	**Part A:** "An Average Week" TG pg. 19 • Follow Activity Instructions for Part A (TG pg. 19) • Review Student Activity Sheet 1C: Last Year's Weather that was completed in Lesson 1 • Engage in a class discussion about the word "average" • Distribute Student Activity Sheet 2A "Five Days' Temperatures" – one per student and allow students to work with partners or in small groups to complete same • Notebook Opportunity TG pg. 20 "What does the word average mean?"
		Activity	- one 30 minute class period	**Part B:** "Organizing Data" TG pg. 20 • Follow Activity Instructions for Part B (TG pg. 20)

				• Explain that using averages can make it easier to manipulate data without losing any important information • Distribute Student Activity Sheet 2B "Simplifying Data" – one per student • Invite students to share completed Activity Sheet 2B "Simplifying Data"
		Evaluation/ Assessment	- two 30 minute class periods	**Part C:** "Reporting the Weather" TG pg. 21 • Follow Activity Instructions for Part C (TG pgs. 21-22) • Divide the class into small groups and present each group with copies of weather forecasts for a five-day period. • Distribute Student Activity Sheet 2C "Reporting Weather" – one per student • Students will share their completed reports • Collect and save Activity Sheet 2C for later use in Lesson 3 • Notebook Opportunity TG pg. 22 "Based on what you have learned, what do you predict next year's weather will be like over the same five-day period?

				• Possible “Extensions” TG pg. 23 • Read pgs. 4-9 “Weather and Climate Patterns” Literacy Series Reader (See Appendix E in TG)
Key Vocabulary: • Average • Cloud • Data • Pattern • Satellite • Technology				

Module #1 "Weather and Climate" *(CBBS -"Weather and Climate Kit")*
Core Lesson #3 *"Weather Patterns"*

Essential Question(s):

- What tools do meteorologists use to predict weather patterns?
- What is the purpose of measuring precipitation?

Objectives	NJSLS Standard(s)	Segment	Time	Instructional Plan/Materials
SWBAT: • Understand that there are patterns to weather events • Analyze and interpret data to better predict future weather events • Compare predictions to results and see how they match up	3.ESS2.1 ESS1.C L.3.4-6 RI.3.1 SL.3.1-2 W.3.2 W.3.10 3.MD.B.3-4 3.NBT.A.1	*Introduction/ Anticipatory Set*	- one 30 minute class period with 5 days of weather observations intervening	**Part A:** "Observing Weather Patterns" TG pg. 33 • Follow Activity Instructions for Part A (TG pgs. 33-35) • Remind students that meteorologists are people who study weather patterns and make prediction about what the weather will be like • Divide students into pairs and distribute one set of materials to each pair. Students will be making a rain gauge to them make observations (5 days) • Distribute a copy of Student Activity Sheet 3A "Observing Weather Patterns at School" TG pg. 34 - one per student • After recording observations for 5 days have students complete Part B of Student Activity Sheet 3A

				"Observing Weather Patterns at School" and engage in a class discussion. • Notebook Opportunity TG pg. 35 "Meteorology is the study of _____."
		Activity	- one 30 minute class period with 5 days of weather observations intervening	**Part B:** "Observing Weather Patterns" TG pg. 35 • Follow Activity Instructions for Part B (TG pgs. 35-37) • Engage students in a discussion about the predictability of the weather • Pass back students' completed copies of Student Activity Sheet 2C "Reporting Weather" that was completed in Lesson 2 • Distribute Student Activity Sheet 3B "Predicting Weather" - one per student • Read aloud pgs. 4-9 "Weather and Climate Patterns" Literacy Reader (See Appendix E of TG) • Notebook Opportunity TG pg. 37 "Meteorologists are people who study _____." • Possible "Extensions" TG pg. 38 • Read pgs. 4,5,8,& 9 "Weather and Climate Patterns" Literacy Series Reader (See Appendix E in

				TG)

Key Vocabulary:

- Condition
- Dry
- Factor
- Ice
- Predict/Predicting/Prediction
- Thunderstorm
- Tornado

Module #1 "Weather and Climate" *(CBBS "Weather and Climate Kit")*
Core Lesson #4 *"Weather v. Climate"*

Essential Question(s):

- How many climate regions are there?
- What determines the climate in an area?

Objectives	NJSLS Standard(s)	Segment	Time	Instructional Plan/Materials
SWBAT: • Identify the relationship between weather and climate • Identify Earth's climate zones • Identify elements of Earth's climate system and how each contributes to climate formation • Identify the relationship between Earth's climate system and climate zones	3.ESS2.2 ESS2.D L.3.6 RI.3.1 RI.3.5 RI.3.7 RL.3.2 SL.3.1 W.3.2 W.3.10 3.MD.A.1 3.MD.B.3 3.OA.A.4 3.OA.B.5	*Introduction/ Anticipatory Set*	- one 30 minute class period	**Part A:** "What Shapes the Climate" TG pg. 47 • Follow Activity Instructions for Part A (TG pgs. 47-48) • Discuss the fact that Earth is completely surrounded by atmosphere • Distribute Student Activity Sheet 4A "Earth's Climate System" – one per student
		Activity	- one 30 minute class period	**Part B:** "Climate Zones" TG pg.48 • Follow Activity Instructions for Part B (TG pgs. 48-49) • Discuss how a region's climate is also affected by its location on Earth • Distribute Student Activity Sheet 4B "Climate Zones" – one per student. Allow students to work in pairs or groups and orally review/share same when done

		Activity	-two 30 minute class periods	**Part C:** "Making a Climate Zone Model" TG pg. 49 • Follow Activity Instructions for Part C (TG pgs. 49-51) • Review the categories that influence atmosphere and shape climate and have students answer questions in their science notebooks • Have children work in small groups to research the climate of a chosen location and model the factors that form its climate • Distribute Student Activity Sheet 4C "What Shapes a Climate? – one per student • As groups conclude their research, distribute a copy of Student Activity Sheet 4D "Modeling a Climate Zone" – one per student • As each group completes its model, distribute Student Activity Sheet 4E "Taking a Vacation" – one per student • Students will share their climate models and completed copies of Student Activity Sheet 4E "Taking a Vacation"

		Evaluation/ Assessment	-one 30 minute class period	**Part D:** "Our Climate" TG pg. 51 • Follow Activity Instructions for Part D (TG pg. 51) • Distribute Student Activity Sheet 4F "The Climate Where We Live – one per student. Students will work in small groups to complete same. • Notebook Opportunity TG pg. 51 "Explain the difference between weather and climate." • Possible "Extensions" TG pg. 52 • Read pgs.10-13 "Weather and Climate Patterns" Literacy Series Reader (See Appendix E in TG)
Key Vocabulary: • Atmosphere • Biosphere • Climate • Cryosphere • Equator • Hydrosphere • Land surface • Polar • Temperature • Tropical				

Module #1 "Weather and Climate" *(CBBS "Weather and Climate Kit")*
Core Lesson #5 *"Hazardous Weather"*

Essential Question(s):

- What are some of the natural hazards connected to the weather?

Objectives	NJSLS Standard(s)	Segment	Time	Instructional Plan/Materials
SWBAT: • Understand that severe weather is usually caused by warm and cold air masses meeting • Learn the types of weather-related hazards that can occur locally • Demonstrate ways in which danger from weather hazards can be reduced	3.ESS3.1 ESS3.B L.3.3 L3.5 L.3.6 RI.3.3 SL.3.1 SL.3.6 W.3.2 W.3.10	*Introduction/ Anticipatory Set*	- one 30 minute class period	**Part A:** "Weather Hazards" TG pg. 65 • Follow Activity Instructions for Part A (TG pgs. 65-66) • Review the atmosphere with students – a layer of gases surrounding Earth • Invite students to describe some of the storms they have seen. Engage in a discussion about flash floods, lightning, hail, and sleet and why they are dangerous • Distribute Student Activity Sheet 5A "Severe Weather Terms" – one per student. Orally review and share when finished same. • Notebook Opportunity TG pg. 66 "Name weather hazards that are common in your area."
		Activity	- two to three 30 minute	**Part B:** "Reducing Weather Hazards" TG pg.66 • Follow Activity Instructions for

			class periods	Part B (TG pgs. 66-67) • Remind students that one purpose of meteorology is to predict future weather events in an effort to keep people safe • Distribute Student Activity Sheet 5B "Reducing Weather-Related Hazards" – one per student. Divide the class into pairs to complete Parts A-E while offering assistance when needed • Collect the sketches and Activity Sheets 5B (A-E) for use in Lesson 6, Part A • Possible Extensions TG pg. 68 • Read pgs.8,9, & 15 "Weather and Climate Patterns" Literacy Series Reader (See Appendix E in TG)
Key Vocabulary: • Air • Air mass • Air pressure • Altitude • Atmosphere • Blizzard • Flash flood • Hail • Hurricane • Lightning • Sleet				

- Snowstorm
- Tornado
- Troposphere
- Wind

Module #1 "Weather and Climate" *(CBBS "Weather and Climate Kit")*
Core Lesson #6 *"Impact of Weather"*

Essential Question(s):

- Why is it important for designers to revise their designs?

Objectives	NJSLS Standard(s)	Segment	Time	Instructional Plan/Materials
SWBAT: • Learn the value of revising a concept to make it better • Understand the power of constructive criticism • Provide feedback in a timely and friendly fashion	3.ESS3.1 ESS3.B L.3.3 L3.5 L.3.6 RI.3.3 SL.3.1 SL.3.6 W.3.2 W.3.10 3.MD.A.1 3.MD.B.3	*Introduction/ Anticipatory Set*	- one 30 minute class period	**Part A:** "Revising the Design Solution" TG pg. 77 • Follow Activity Instructions for Part A (TG pgs. 77-78) • Explain that often, when people design things, their first design needs to be changed as technology gets better with time • Have children meet with the partners they worked with in Lesson 5 and trade designs with another student pair • Distribute Student Activity Sheet 6A "Revising Your Design" – one per student. Direct students (working in their original pairs) to brainstorm ways to make their designs better. When they have finished, collect Student Activity Sheets 5B and 6A for use in Part B of this lesson • Notebook Opportunity TG pg. 78 "Why have weather safety systems gotten better over the

				years?"
		Activity	- three to four 30 minute class periods	**Part B:** "Reducing the Impact of Weather Hazards" TG pg.78 • Follow Activity Instructions for Part B (TG pgs. 78-79) • Pairs will develop and deliver presentations to the class about their improved design solutions • Distribute Student Activity Sheet 6B "Protecting People and Property" – one per student • After all pairs have made their presentations, instruct them to answer the conclusion questions in Part E individually • Distribute the summative assessment and have students complete same to evaluate understanding of key unit concepts • Read pgs. 8,9, & 15 "Weather and Climate Patterns" Literacy Series Reader (See Appendix E in TG)
Key Vocabulary: **All vocabulary from previous lessons**				

Module #2a "Forces and Interactions" *(CBBS – "Forces and Interactions Kit")*

How do equal and unequal forces on an object affect the object?

In this unit of study, students are able to determine the effects of balanced and unbalanced forces on the motion of an object. The crosscutting concepts of patterns and cause and effect are identified as organizing concepts for these disciplinary core ideas. In the third-grade performance expectations, students are expected to demonstrate grade-appropriate proficiency by planning and carrying out investigations. Students are expected to use these practices to demonstrate understanding of the core ideas.

New Jersey Student Learning Standards/Student Learning Objectives

Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object. *[Clarification Statement: Examples could include an unbalanced force on one side of a ball can make it start moving; and, balanced forces pushing on a box from both sides will not produce any motion at all.] [*Assessment Boundary: Assessment is limited to one variable at a time: number, size, or direction of forces. Assessment does not include quantitative force size, only qualitative and relative. Assessment is limited to gravity being addressed as a force that pulls objects down.*]* **(3-PS2-1)**

Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion. *[Clarification Statement: Examples of motion with a predictable pattern could include a child swinging in a swing, a ball rolling back and forth in a bowl, and two children on a see-saw.] [*Assessment Boundary: Assessment does not include technical terms such as period and frequency.*]* **(3-PS2-2)**

Benchmark Assessment:

Unit Sequence	
Part A: *How do scientists play soccer?*	
Concepts	**Formative Assessment**
• Science investigations use a variety of methods, tools, and techniques. • Cause-and-effect relationships are routinely identified. • Objects in contact exert forces on each other. • Each force that acts on a particular object has both strength and a direction. • An object at rest typically has multiple forces acting on it, but they add to zero net force on the object. • Forces that do not sum to zero can cause changes in the object's speed or direction of motion. *(Qualitative and conceptual, but not quantitative, addition of forces are used at this level.)*	*Students who understand the concepts are able to:* • Identify cause-and-effect relationships. • Plan and conduct investigations collaboratively to produce data to serve as the basis for evidence. • Use fair tests in which variables are controlled and the number of trials considered. • Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object. *(Assessment is limited to one variable at a time: number, size, or direction of forces. Assessment does not include quantitative force size, only qualitative and relative. Assessment is also limited to gravity being addressed as a force that pulls objects down.) Examples could include:* ✓ *An unbalanced force on one side of a ball can make it start moving.* ✓ *Balanced forces pushing on a box from both sides*

What It Looks Like in the Classroom
In this unit of study, students look for cause-and-effect relationships as they investigate the effects of balanced and unbalanced forces on the motion of an object. They learn that objects in contact exert forces on each other, and these forces have both strength and direction. When forces are balanced, there is no change in the motion or the position of an object. In other words, an object at rest typically has multiple forces acting on it, but the forces balance out to equal a zero net force on the object. For example, if two children stand with their hands together and push against each other, the pushing force each exerts balances to a net zero effect if neither child moves. Pushing a box from both sides also demonstrates a balanced force if the forces do not produce any change in motion or position of the box. When forces are unbalanced, however, there is a change in the motion and/or position of the object the forces are acting on. If the same two children from the example above were pushing against each other, and one child moves his/her hands, arms, or feet forward while the other child moves backward, this would demonstrate an unbalanced force. The first child is pushing with greater force than the second. Through planning and conducting investigations, students will come to understand that forces that result in changes in an object's speed or direction of motion are unbalanced. Students can observe everyday examples on the playground, with seesaws and swings and by kicking and throwing soccer balls. As they conduct investigations and make observations, students should identify the cause-and-effect relationships at work and identify the objects that are exerting forces on one another. They should also use qualitative descriptions when identifying the relative strength (greater than, less than, equal) and direction of the forces, even if an object is at rest. Investigating the effects of forces on objects will also give students opportunities to observe that patterns exist everywhere. Patterns are found in shapes, structures, natural environments, and recurring events. Scientists and engineers analyze patterns to make predictions, develop questions, and create solutions. As students have opportunities to observe forces interacting with objects, they will ask questions and analyze and interpret data in order to identify patterns of change in the motion of objects and to make predictions about an object's future motion. When students are on the playground, they can observe multiple patterns of change in the back-and-forth motion of a child swinging on a swing or in the up-and-down motion of a seesaw. In the classroom, students can observe a variety of objects, such as marbles rolling back and forth in bowls or tops spinning across the floor. Throughout this unit, as students plan and carry out investigations, it is extremely important that they routinely identify cause-and-effect relationships and look for patterns of change as objects interact. As students interact with objects, such as when they push a door closed, bounce a ball, or roll a ball down a ramp, they may ask, "What caused the changes that I observed? How can I change the way in which the object moved?" Students need to have many experiences in order to deepen their understanding of the cause-and-effect relationships between balanced and unbalanced forces on the motion of an object, and they should be guided to plan and conduct fair tests, testing only one variable at a time.

Connecting with English Language Arts/Literacy and Mathematics
English Language Arts ✓ In order to integrate the CCSS for ELA into this unit, students need opportunities to read content-specific texts to deepen their understanding of force and motion. As they read, teachers should pose questions such as, "What interactions can you identify between the objects in the text?" and "What patterns of motion are described in the text?" Students should be encouraged to answer questions and cite evidence from the text to support their thinking. ✓ To further support the integration of the ELA standards, students can also conduct short research projects about simple force-and-motion systems and the interactions that occur among forces and objects within the systems. For example, students could be asked to conduct a short study by bouncing a ball 10 times and identifying the patterns they observe. Next students could predict, based on the patterns they saw, what would happen if they bounced the ball 10 more times. Students then could draw a model of the force and motion system, identifying the structures and forces that interact within the system. This would also give students the opportunity to develop note-taking skills and use multiple sources to collect information about force and motion. *Mathematics* ✓ In order to integrate the Common Core State Standards for Mathematics, students can use measurement tools in a variety of ways to conduct investigations. Students could find the mass of an object in order to understand that the heavier something is, the greater the force needed to cause a change in its motion. Students could use rulers or tape measures to measure the distance an object moves. Student can then record and analyze their data to determine patterns of change and explain cause-and-effect relationships, while reasoning abstractly and quantitatively.

Modifications	
Special Education: • Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community. • Provide students with multiple choices for how they can represent their understandings (e.g. multi-sensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling). • Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies). • Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences). • Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings. • Teacher models • Show additional number of samples/examples • Provide additional opportunities to practice • Use re-teaching and/or restating to address student's needs • Use small group table conferences to address needs • Develop target vocabulary • Scaffold comprehension when reading is necessary to fully understand science concept(s) • Use graphic organizers to develop key concepts/ideas • Teach key aspects of a topic and eliminate nonessential information.	**English Language Learners (ELLs):** • Model Thinking Aloud • Encourage Partner Talk • Repeat and Clarify • Provide a Sequence • Encourage self-selection of topics • Target vocabulary • Scaffold comprehension when reading is used to promote reader response • Scaffold content-literacy reading • Allow products to demonstrate student's learning • Provide on-going feedback

Students at Risk of School Failure:	**Gifted Students:**
● Build a relationship ● Allow flexible due dates ● Employ strategies from *"Classroom Instruction that Works"* ● Create the Opportunity to Learn strategies ● Build lessons around student interests	• Utilize flexible groups-group gifted students with other gifted students or higher-level learners • Encourage students to explore/research concepts in depth via independent studies or investigations (individual/group) • Differentiate product assignments. Employ differentiated curriculum to keep interest/motivation high • Encourage creative expression and thinking by allowing students to choose how to approach a problem or assignment (problem based learning) • Invite students to explore different points of view on a topic of study and compare the two • Provide multiple opportunities for students to "Own Their Learning" • Ask students higher-level questions that require students to look into causes, experiences, and facts to draw a conclusion to other areas of learning. (Webb's Depth of Knowledge- Level 4) • Create a room environment that encourages creativity and discovery through the use of interesting literature and reference materials. Supply reading materials on a wide variety of subjects and levels • Provide a learning-rich environment that includes a variety of resources, media, tasks, and methods of teaching

Prior Learning

Kindergarten Unit 1: Pushes and Pulls

- Pushes and pulls can have different strengths and directions.
- Pushing or pulling on an object can change the speed or direction of the object's motion and can start or stop it.
- When objects touch or collide, they push on one another and can change motion.
- A bigger push or pull causes things speed up or slow down more quickly.

Grade 1 Unit 1: Patterns of Change in the Sky

- Patterns of the motion of the sun, moon, and stars in the sky can be observed, described, and predicted.

Future Learning

Grade 4 Unit 5: Energy Transfer

- Waves, which are regular patterns of motion, can be made in water by disturbing the surface. When waves move across the surface of deep water, the water goes up and down in place; there is no net motion in the direction of the wave except when water meets a beach.
- Waves of the same type can differ in amplitude (height) and length (the spacing between wave peaks).

Grade 5 Unit 6: Interactions Within the Earth, Sun and Moon System

- The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center.

Grade 6 Unit 4: Force and Motion

- For any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first, but in the opposite direction (Newton's third law).
- The motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero, the object's motion will change. The greater the mass of the object, the greater the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion.

- All positions of objects and the directions of forces and motions must be described in an arbitrarily chosen reference frame and arbitrarily chosen units of size. In order to share information with other people, these choices must also be shared.
- 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.
- 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 is 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.
- The solar system appears to have formed from a disk of dust and gas, drawn together by gravity.
- Water continually cycles among land, ocean, and the atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land.
- The complex patterns of the changes in the movement of water in the atmosphere are determined by winds, landforms, and ocean temperatures and currents; which are major determinants of local weather patterns.
- Global movements of water and its changes in form are propelled by sunlight and gravity.
- Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents.
- Water's movements—both on land and underground—cause weathering and erosion, which change the land's surface features and create underground formations.

Appendix A: NGSS and Foundations for the Module		
Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object. *[Clarification Statement: Examples could include an unbalanced force on one side of a ball can make it start moving; and, balanced forces pushing on a box from both sides will not produce any motion at all.] [*Assessment Boundary: Assessment is limited to one variable at a time: number, size, or direction of forces. Assessment does not include quantitative force size, only qualitative and relative. Assessment is limited to gravity being addressed as a force that pulls objects down.*]* **(3-PS2-1)**		
Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion. *[Clarification Statement: Examples of motion with a predictable pattern could include a child swinging in a swing, a ball rolling back and forth in a bowl, and two children on a see-saw.] [*Assessment Boundary: Assessment does not include technical terms such as period and frequency.*]* **(3-PS2-2)**		
The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:		
Science and Engineering Practices	**Disciplinary Core Ideas**	**Crosscutting Concepts**
<u>Planning and Carrying Out Investigations</u> • Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. (3-PS2-1) • Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. (3-PS2-2)	**<u>PS2.A: Forces and Motion</u>** • Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion. (Boundary: Qualitative and conceptual, but not quantitative addition of forces are used at this level.) (3-PS2-1) • The patterns of an object's motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it. (Boundary: Technical terms, such as magnitude, velocity, momentum, and vector quantity, are not	**<u>Cause and Effect</u>** • Cause and effect relationships are routinely identified. (3-PS2-1) **<u>Patterns</u>** • Patterns of change can be used to make predictions. (3-PS2-2) - ***Connections to Nature of Science*** **Science Knowledge is Based on Empirical Evidence** • Science findings are based on recognizing patterns. (3-PS2-2) **Scientific Investigations Use a Variety of Methods**

	introduced at this level, but the concept that some quantities need both size and direction to be described is developed.) (3-PS2-2) **PS2.B: Types of Interactions** • Objects in contact exert forces on each other. (3-PS2-1)	• Science investigations use a variety of methods, tools, and techniques. (3-PS2-1)

English Language Arts	Mathematics
Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers. **RI.3.1** (3-PS2-1) Conduct short research projects that build knowledge about a topic. **W.3.7** (3-PS2-1),(3-PS2-2) Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories. **W.3.8** (3-PS2-1),(3-PS2-2)	Reason abstractly and quantitatively. **MP.2** (3-PS2-1) Use appropriate tools strategically. **MP.5** (3-PS2-1) Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l). Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units, e.g., by using drawings (such as a beaker with a measurement scale) to represent the problem. **3.MD.A.2** (3-PS2-1)

Module #2b "Forces and Interactions" *(CBBS – "Forces and Interactions Kit")*

How can we use our understandings about magnets be used to solve problems?

In this unit of study, students determine the effects of balanced and unbalanced forces on the motion of an object and the cause-and-effect relationships of electrical or magnetic interactions to define a simple design problem that can be solved with magnets. The crosscutting concept of *cause and effect*, and the *interdependence of science, engineering, and technology, and the influence of engineering, technology, and science on society and the natural world* are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in *asking questions and defining problems*. Students are also expected to use these practices to demonstrate understanding of the core ideas.

This unit is based on 3-PS2-3, 3-PS2-4, and 3-5-ETS1-1.

New Jersey Student Learning Standards/Student Learning Objectives

Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other. *[Clarification Statement: Examples of an electric force could include the force on hair from an electrically charged balloon and the electrical forces between a charged rod and pieces of paper; examples of a magnetic force could include the force between two permanent magnets, the force between an electromagnet and steel paperclips, and the force exerted by one magnet versus the force exerted by two magnets. Examples of cause and effect relationships could include how the distance between objects affects strength of the force and how the orientation of magnets affects the direction of the magnetic force.] [Assessment Boundary: Assessment is limited to forces produced by objects that can be manipulated by students, and electrical interactions are limited to static electricity.]* **(3-PS2-3)**

Define a simple design problem that can be solved by applying scientific ideas about magnets.* *[Clarification Statement: Examples of problems could include constructing a latch to keep a door shut and creating a device to keep two moving objects from touching each other.]* **(3-PS2-4)**

Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost. (3-5-ETS1-1)

Unit Sequence	
Part A: *What are the relationships between electrical and magnetic forces?*	
Concepts	**Formative Assessment**
• Cause-and-effect relationships are routinely identified, tested, and used to explain change. • Electric and magnetic forces between a pair of objects do not require that the objects be in contact. • The sizes of the forces in each situation depend on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other.	*Students who understand the concepts are able to:* • Identify and test cause-and-effect relationships in order to explain change. • Ask questions that can be investigated based on patterns such as cause-and-effect relationships. • Ask questions to determine cause-and-effect relationships in electric or magnetic interactions between two objects not in contact with each other. *(Assessment is limited to forces produced by objects that can be manipulated by students, and electrical interactions are limited to static electricity.)* • Magnetic forces could include: ✓ The force between two permanent magnets; ✓ The force between an electromagnet and steel paperclips; ✓ The force exerted by one magnet versus the force exerted by two magnets. • Cause-and-effect relationships could include: ✓ How the distance between objects affects the strength of the force ✓ How the orientation of magnets affects the direction of the magnetic force.

Module Sequence	
Part B: *How can we use our understandings about magnets be used to solve problems?*	
Concepts	**Formative Assessment**
• Scientific discoveries about the natural world can often lead to new and improved technologies, which are developed through the engineering design process. • People's needs and wants change over time, as do their demands for new and improved technologies. • Electric and magnetic forces between a pair of objects do not require that the objects be in contact. • The sizes of the forces in each situation depend on the properties of the objects and their distances apart. • For forces between two magnets, the size of the force depends on their orientation relative to each other. • Possible solutions to a problem are limited by available materials and resources (constraints). • The success of a designed solution is determined by considering the desired features of a solution (criteria). • Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account.	*Students who understand the concepts are able to:* • Define a simple problem that can be solved through the development of a new or improved object or tool. • Define a simple design problem that can be solved by applying scientific ideas about magnets (e.g., constructing a latch to keep a door shut or creating a device to keep two moving objects from touching each other). • Define a simple design problem that can be solved through the development of an object, tool, process, or system, and include several criteria for success and constraints on material, time, or cost. • Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

What It Looks Like in the Classroom
After investigating electrical and magnetic forces, students will engage in a portion of the engineering design process in order to define a simple design problem that can be solved by applying scientific ideas about magnets. This process should include the following steps: ✓ As a class, create a list of the properties of magnets. (See content descriptions above) ✓ Brainstorm a list of everyday objects that use magnets, and discuss the function of the magnet(s) in each object. For example, electric can openers have a strong magnet that attaches a can to the device as it cuts through (opens) the top of the can. ✓ In small groups or pairs, students discuss possible everyday problems that might be solved using magnets. For example, they could construct a latch to keep a door shut. ✓ As a class, determine possible criteria that might be used to determine how successful the devices might be, and discuss possible constraints (on materials, time, or cost) that might affect each group's design solution. ✓ Small groups or pairs should have the opportunity to create a presentation (poster, PowerPoint, drawings, or actual physical model, if time permits) to share both the design problem and solution with the class. In this unit, students are not expected to build and test their design solutions or to optimize their designs; however, they can compare different proposals for solutions on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. The overall goal is for students to understand that engaging in engineering design will help them understand that scientific discoveries about the natural world can often lead to new and improved technologies, which are developed through the engineering design process, and that as people's needs and wants change over time, so do their demands for new and improved technologies. Engineering design is an important part of this unit of study. Students are expected to define a simple design problem that can be solved by applying scientific ideas and determine possible success criteria and constraints on time, materials, and cost. They should also compare different proposals for solutions based on how well the proposed solutions meet the criteria for success or how well each takes the constraints into account.

Connecting with English Language Arts/Literacy and Mathematics
English Language Arts Students should be given opportunities to conduct short research projects that build knowledge about electric and magnetic forces. They should be given multiple opportunities to recall and gather information from their investigations as well as from print and digital sources. Students should use that information to answer questions, describe cause-and-effect relationships, make comparisons, and explain interactions between objects when electrical or magnetic forces are involved. Teachers should provide a variety of texts for students to explore in order to develop students' note-taking skills. As students take notes, they should use graphic organizers, such as Venn diagrams and T-charts, to sort supporting evidence into provided categories. For example, as students read a variety of texts about forces, they can take notes and then sort the evidence they collect into categories, such as electrical and magnetic forces. *Mathematics* Students should use measurement tools in a variety of ways as they conduct investigations. They could find the mass of an object in order to understand that the more mass an object has, the greater the force needed to attract, repel, or move it. Students then reason mathematically as they analyze their data to determine patterns of change that can be used to support explanations of cause-and-effect relationships. Students might also use algebraic reasoning during investigations. For example, when measuring magnetic strength by increasing the number of magnets, students can use multiplication to make predictions about possible outcomes. So, if a paper clip moves toward a single magnet when it is 2 centimeters away, then students might predict that the paper clip will move toward a double magnet when it is 4 centimeters away. Or, if the paper clip moved towards a set of four magnets at a distance of 8 centimeters, then students might predict that the paper clip will move toward a single magnet when it is 2 centimeters away.

Modifications	
Special Education: • Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community. • Provide students with multiple choices for how they can represent their understandings (e.g. multi-sensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling). • Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies). • Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences). • Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings. • Teacher models • Show additional number of samples/examples • Provide additional opportunities to practice • Use re-teaching and/or restating to address student's needs • Use small group table conferences to address needs • Develop target vocabulary • Scaffold comprehension when reading is necessary to fully understand science concept(s) • Use graphic organizers to develop key concepts/ideas • Teach key aspects of a topic and eliminate nonessential information.	**English Language Learners (ELLs):** • Model Thinking Aloud • Encourage Partner Talk • Repeat and Clarify • Provide a Sequence • Encourage self-selection of topics • Target vocabulary • Scaffold comprehension when reading is used to promote reader response • Scaffold content-literacy reading • Allow products to demonstrate student's learning • Provide on-going feedback

Students at Risk of School Failure:	**Gifted Students:**
● Build a relationship ● Allow flexible due dates ● Employ strategies from *"Classroom Instruction that Works"* ● Create the Opportunity to Learn strategies ● Build lessons around student interests	• Utilize flexible groups-group gifted students with other gifted students or higher-level learners • Encourage students to explore/research concepts in depth via independent studies or investigations (individual/group) • Differentiate product assignments. Employ differentiated curriculum to keep interest/motivation high • Encourage creative expression and thinking by allowing students to choose how to approach a problem or assignment (problem based learning) • Invite students to explore different points of view on a topic of study and compare the two • Provide multiple opportunities for students to "Own Their Learning" • Ask students higher-level questions that require students to look into causes, experiences, and facts to draw a conclusion to other areas of learning. (Webb's Depth of Knowledge- Level 4) • Create a room environment that encourages creativity and discovery through the use of interesting literature and reference materials. Supply reading materials on a wide variety of subjects and levels • Provide a learning-rich environment that includes a variety of resources, media, tasks, and methods of teaching •

Prior Learning

Kindergarten Unit 1: Pushes and Pulls

- Pushes and pulls can have different strengths and directions.
- Pushing or pulling on an object can change the speed or direction of its motion and can start or stop it.
- When objects touch or collide, they push on one another and can change motion.
- A bigger push or pull makes things speed up or slow down more quickly.
- A situation that people want to change or create can be approached as a problem to be solved through engineering. Such problems may have many acceptable solutions. *(secondary)*

Grade 1 Unit 1: Patterns of Change in the Sky

- Patterns of the motion of the sun, moon, and stars in the sky can be observed, described, and predicted.

Future Learning

Grade 4 Unit 7: Using Engineering Design with Force and Motion Systems

- Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. *(secondary)*

Grade 6 Unit 5: Types of Interactions

- Electric and magnetic (electromagnetic) forces can be attractive or repulsive, and their sizes depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects.
- Gravitational forces are always attractive. There is a gravitational force between any two masses, but it is very small except when one or both of the objects have large mass—e.g., Earth and the sun.
- Forces that act at a distance (electric, magnetic, and gravitational) can be explained by fields that extend through space and can be mapped by their effect on a test object (a charged object, or a ball, respectively).

Appendix A: NGSS and Foundations for the Module		
Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other. *[Clarification Statement: Examples of an electric force could include the force on hair from an electrically charged balloon and the electrical forces between a charged rod and pieces of paper; examples of a magnetic force could include the force between two permanent magnets, the force between an electromagnet and steel paperclips, and the force exerted by one magnet versus the force exerted by two magnets. Examples of cause and effect relationships could include how the distance between objects affects strength of the force and how the orientation of magnets affects the direction of the magnetic force.] [Assessment Boundary: Assessment is limited to forces produced by objects that can be manipulated by students, and electrical interactions are limited to static electricity.]* **(3-PS2-3)**		
Define a simple design problem that can be solved by applying scientific ideas about magnets.* *[Clarification Statement: Examples of problems could include constructing a latch to keep a door shut and creating a device to keep two moving objects from touching each other.]* **(3-PS2-4)**		
Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost. (3-5-ETS1-1)		
The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:		
Science and Engineering Practices	**Disciplinary Core Ideas**	**Crosscutting Concepts**
Analyzing and Interpreting Data • Analyze and interpret data to make sense of phenomena using logical reasoning. (3-LS3-1) **Asking Questions and Defining Problems** • Ask questions that can be investigated based on patterns such as cause and effect relationships. (3-PS2-3) • Define a simple problem that can be solved through the development of a new or improved object or tool. (3-PS2-4)	**PS2.B: Types of Interactions** • Electric and magnetic forces between a pair of objects do not require that the objects be in contact. The sizes of the forces in each situation depend on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other. (3-PS2-3),(3-PS2-4) **ETS1.A: Defining and Delimiting Engineering Problems** • Possible solutions to a problem are limited by available materials and	**Cause and Effect** • Cause and effect relationships are routinely identified, tested, and used to explain change. (3-PS2-3) - ***Connections to Engineering, Technology, and Applications of Science*** **Interdependence of Science, Engineering, and Technology** • Scientific discoveries about the natural world can often lead to new and

• Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost. (3-5-ETS1-1)	resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (3-5-ETS1-1)	improved technologies, which are developed through the engineering design process. (3-PS2-4)

English Language Arts	Mathematics
Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers. (3-PS2-3) **RI.3.1** Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect. (3-PS2-3) **RI.3.3** Describe the logical connection between particular sentences and paragraphs in a text (e.g., comparison, cause/effect, first/second/third in a sequence). (3-PS2-3) **RI.3.8** Ask and answer questions about information from a speaker, offering appropriate elaboration and detail. (3-PS2-3) **SL.3.3**	**N/A**

Module #2 "Forces and Interactions" *(CBBS "Forces and Interactions Kit")* **Core Lesson #1** *"Balanced Forces"*				
Essential Question(s): • What are balanced forces?				
Objectives	**NJSLS Standard(s)**	**Segment**	**Time**	**Instructional Plan/Materials**
SWBAT: • Use a beam board and fulcrum to make a scale • Manipulate different objects to determine their relative masses • Relate an object at rest to an object that has more than one force applied to it • Categorize forces as pushes or pulls	3.PS2.1 PST.A PST.B L.3.6 RI.3.3 SL.3.1 W.3.2 3.MD.A.2 3.NBT.A.1-2 3.OA.A.3	*Introduction/ Anticipatory Set*	- one 35 minute class period	**Part A:** Pre-Unit Assessment "How Do Things Become Balanced?" TG pg. 4 • Follow Activity Instructions for Part A (TG pgs. 4-5) • Distribute one bag of materials to each group of four students and one copy of Activity Sheet 1A "Balance Beam" – one per student • Engage in a class discussion about how each of the ways to balance the beam use an equal amount of paper clips on both ends of the beam • Notebook Prompt TG pg.5 "Explain how a balanced beam can become unbalanced."
		Activity	- one 35 minute class period	**Part B:** "Balancing Masses" TG pg. 6 • Follow Activity Instructions for Part B (TG pgs. 6-7) • Review what needs to happen in order for a balance beam to be

				balanced • Distribute materials – one bag per small group and investigate how many small washers are equal to 10 grams • Small groups will work together to investigate the mass of 3 different classroom objects and record findings in their science notebooks before orally reviewing same
		Evaluation/ Assessment	- one 35 minute class period	**Part C:** "Gravity Pulls Its Weight" TG pg. 8 • Follow Activity Instructions for Part C (TG pgs. 8-10) • Review the unit of measure students used in Part B (Grams) • Distribute materials to small groups – one bag per group • Demonstrate to students another force - gravity • Distribute Student Activity Sheet 1B "Objects At Rest" – one per student • Notebook Opportunity TG pg. 10 "Explain what happens to an object when two equal forces are applied to it." • Notebook Prompt TG pg.12 "Give an example of the forces

				being applied to any object at rest." • Possible "Extensions" TG pg. 11 • Read pgs. 2-8 "Forces and Interactions" Literacy Series Reader (See Appendix E in TG)
Key Vocabulary: • Balance • Balanced forces • Equal • Even • Force • Fulcrum • Gram • Gravity • Level • Mass • Scale • Weight				

Module #2 "Forces and Interactions" *(CBBS "Forces and Interactions Kit")* **Core Lesson #2** *"Unbalanced Forces"*				
Essential Question(s): • What are unbalanced forces?				
Objectives	**NJSLS Standard(s)**	**Segment**	**Time**	**Instructional Plan/Materials**
SWBAT: • Recognize that an object at rest will remain at rest until an unbalanced force is applied to it • Identify forces that cause an object to stop moving • Assess different ways that friction can affect the motion of an object • Predict different ways to reduce friction	3.PS2.1-2 PST.A PST.B L.3.6 RI.3.1-5 RI.3.7 SL.3.1 W.3.2 W.3.7 3.MD.A.2 3.NBT.A.1-2 3.OA.A.3	*Introduction/ Anticipatory Set*	- one 35 minute class period	**Part A:** "Inertia: Objects Stay and Objects Go" TG pg. 21 • Follow Activity Instructions for Part A (TG pgs. 21-25) • Review why an object is at rest when it has more than one force being applied to it • Distribute a bag of materials – one per small group and use the charts in Figures 2.1-2.3 TG pgs. 22 -24 to conduct experiments. Students will record results in their science notebooks and share same • Notebook Opportunity TG 25 "What is one of the balanced forces that acts upon the car when it is at rest? What is the force that causes the car to move?
		Activity	- one 35 minute class period	**Part B:** "Inertia Keeps It Moving" TG pg. 26 • Follow Activity Instructions for Part B (TG pgs. 26-28)

				• Review inertia and distribute materials to small groups – one bag per group • Distribute Student Activity Sheet 2A "Bodies in Motion" – one per student • Students will conduct experiments and share results when done • Notebook Opportunity TG pg. 29 "Write to explain the difference between the forces being applied to the washer when the car is at rest and when the car is in motion
		Evaluation/ Assessment	- one 35 minute class period	**Part C:** "Slowing Down with Friction" TG pg. 29 • Follow Activity Instructions for Part C (TG pgs. 29-30) • Students will work in small groups to investigate friction by examining the way the car moves when it travels on surfaces of different textures – one bag of materials per group • Distribute Student Activity Sheet 2B "Slowing Down with Friction" – one per student. Share results when done • Distribute a copy of Literacy and Science 2 "Forces and Motion" –

				one per student and read aloud/discuss the brochure • Notebook Opportunity TG pg. 31 • Notebook Prompt TG pg. 33 "Use evidence from your investigations to explain how you can move an object without touching it with your hands." • Possible "Extensions" TG pg. 32 • Read pgs. 6-7 "Forces and Interactions" Literacy Series Reader (See Appendix E in TG)
Key Vocabulary: • Friction • Gram • Inertia • Isaac Newton • Motion • Newton • Spring scale				

Module #2 "Forces and Interactions" *(CBBS "Forces and Interactions Kit")* **Core Lesson #3** *"Changes in Motion"*				
Essential Question(s): • How do unbalanced forces act on an object?				
Objectives	**NJSLS Standard(s)**	**Segment**	**Time**	**Instructional Plan/Materials**
SWBAT: • Determine that objects move faster or slower depending on the strength of the force • Evaluate that adding mass can slow down a moving object	3.PS2.2 PST.A PST.B L.3.6 RI.3.3 SL.3.1 W.3.2 3.NBT.A.1-2 3.MD.B.3	*Introduction/ Anticipatory Set*	- one 35 minute class period	**Part A:** "Going the Distance" TG pg. 43 • Follow Activity Instructions for Part A (TG pg. 43-44) • Engage in a discussion about force and motion. Provide examples for students (pulling, pushing, gravity, inertia, friction) • Distribute Student Activity Sheet 3A "Strong and Stronger" – one per student and allow students to work in small groups to complete same • Orally review and discuss student groups' observations and conclusions
		Activity	- one 35 minute class period	**Part B:** "I Like to Move It, Move It" TG pg. 44 • Follow Activity Instructions for Part B (TG pgs. 44-46) • Review and discuss the investigation from Part A • Distribute one bag of materials to

				each small group along with Student Activity Sheet 3B "Change in Motion" – one per student • Refer to Figure 3.1 TG pg. 45 and model/guide groups to set up for the car-and-string setup on elevated workstation • Allow students time to formulate conclusions Student Activity Sheet 3B Part E and discuss/share same
		Evaluation/ Assessment	- one 35 minute class period	**Part C:** "Heavy Loads, Stronger Forces" TG pg. 46 • Follow Activity Instructions for Part C (TG pgs. 46-48) • Discuss the change in motion that students observed in Student Activity Sheet 3B Part B. • Distribute Student Activity Sheet 3C "Heavy Loads" – one per student along with one bag of materials for each group • Ask students to formulate conclusions in Student Activity Sheet 3B Part C and share • Students will share their completed reports • Notebook Prompt TG pg. 50 "Use evidence from your

				investigation to explain how you know that when more mass was used to pull the car, the car traveled faster." • Possible "Extensions" TG pgs. 49-50 • Read pgs. 9-11 "Forces and Extensions" Literacy Series Reader (See Appendix E in TG)
Key Vocabulary: • Acceleration • Decrease • Distance • Increase • Load • Speed • strength				

Module #2 "Forces and Interactions" *(CBBS "Forces and Interactions Kit")*
Core Lesson #4 *"Magnetism and Electricity"*

Essential Question(s):

- What is the connection between magnetism and electricity?

Objectives	NJSLS Standard(s)	Segment	Time	Instructional Plan/Materials
SWBAT: • Determine that the direction of the force of a magnet on materials made of iron is a pull • Observe and investigate the relationship between the pushes or pulls of magnets on other magnets and the direction of their poles • Demonstrate how opposite electric charges attract and like charges repel each other • Explain the similarities and differences between electric and magnetic forces	3.PST.3 PS2.A-B L.3.6 RI.3.3 RI.3.9 SL.3.1 W.3.2 3.NBT.A.1 3.MD.B.3	*Introduction/ Anticipatory Set*	- one 35 minute class period	**Part A:** "Magnetic Metals" TG pg. 63 • Follow Activity Instructions for Part A (TG pgs. 63-64) • Discuss the different ways forces can be applied to an object (pushes and pulls) • Make a T-chart see Figure 4.1 in TG pg. 63 • Small groups will travel to 4 stations to test their magnets and record findings in Science Notebooks • Notebook Opportunity TG pg. 64 "Explain whether or not it is likely for a metal washer to contain iron, based on your observations and evidence from the activity."
		Activity	- one 35 minute class	**Part B:** "Magnetic Field" TG pg.64 • Follow Activity Instructions for Part B (TG pgs. 64-66)

			period	• Review types of objects that are attracted to magnets • Distribute Student Activity Sheet 4A "Magnetic Field" – one per student. Allow students to work in pairs or groups and orally review/share same when done. Refer to Figure 4.2 in TG pg. 66 • Notebook Opportunity TG pg. 66 "Use evidence from your investigation to explain how you know that the poles of the bar magnet have a stronger magnetic force than the middle of the bar magnet
		Activity	-two 35 minute class periods	**Part C:** "Opposites Attract" TG pg. 67 • Follow Activity Instructions for Part C (TG pgs. 67-68) • Review what happened to the iron fillings when both the opposite and similar poles of the magnets were facing each other • Distribute Student Activity Sheet 4B "Opposites Attract" – one per student. Distribute one bag of materials to each small group • Distribute Student Activity Sheet 4C "Ring Magnets by Design – one per student

				• As groups conclude their research, distribute a copy of Student Activity Sheet 4D "Modeling a Climate Zone" – one per student • Allow groups to conduct investigations and share plans, designs, and conclusions
		Evaluation/ Assessment	-one 35 minute class period	**Part D:** "Electricity Attracts and Repels" TG pg. 68 • Follow Activity Instructions for Part D (TG pg. 68-71) • Review how opposite sides of magnets attract each other while similar sides repel • Distribute Student Activity Sheet 4D "Static Spiral"– one per student and one bag of materials to each small group • Distribute Student Activity Sheet 4E "Attracting or Repelling Charges? – one per student • Students will conduct investigations and discuss outcomes as a class • Notebook Opportunity TG pg. 71 "Using evidence from the investigation, explain the relationship between positive and negative charges and attracting

				and repelling • Possible “Extensions” TG pg. 72 • Read pgs. 4-7 “Forces and Interactions” Literacy Series Reader (See Appendix E in TG) • Take Home Science TG pg. 71- send home Take-Home Science General Letter (Appendix C) with activity sheet
Key Vocabulary: • Attract • Charge • Magnet • Magnetic field • Magnetism • Repel • Static electricity				

Module #2 "Forces and Interactions" *(CBBS -"Forces and Interactions Kit")*
Core Lesson #5 *"Magnetic Solutions"*

Essential Question(s):

- How can magnets be used to solve problems?

Objectives	NJSLS Standard(s)	Segment	Time	Instructional Plan/Materials
SWBAT: • Reinforce previous learning about natural forces, including gravity and magnetism • Design an efficient model of magnetism	3.PS2.4 PST.A-B L.3.6 RI.3.3 SL.3.1 SL.3.4 W.3.2 3.NBT.A.1-2 3.MD.B.3	*Introduction/ Anticipatory Set*	- one 35 minute class period	**Part A:** "Fun Forces and Interesting Interactions TG pg. 91 • Follow Activity Instructions for Part A (TG pgs. 91-92) • Review balance, Newton's third law of motion, friction, and magnetism • Distribute a copy of Student Activity Sheet 5A "Fun Forces and Interesting Interactions" TG pg. 92 - one per student • Notebook Opportunity TG pg. 92 "Name three forces that can act on an object
		Activity	- two to three 35 minute class periods	**Part B:** "More with Magnetism" TG pg. 92 • Follow Activity Instructions for Part B (TG pgs. 92-94) • Distribute Student Activity Sheet 5B "More with Magnetism" – one per student • Students will conduct

				investigations in small groups and orally present when finished • Distribute a copy of the summative assessment to each student • Possible "Extensions" TG pg. 95 • Read pgs. 12-15 "Forces and Interactions" Literacy Series Reader (See Appendix E in TG)
Key Vocabulary: All vocabulary from previous lessons				

Module #3a "Traits and Continuing the Life Cycle" (TCI's Science Alive! Unit #4 "Life Cycles and Traits")

What kinds of traits are passed on from parent to offspring?

What environmental factors might influence the traits of a specific organism?

In this unit of study, students acquire an understanding that organisms have different inherited traits and that the environment can also affect the traits that an organism develops. The crosscutting concepts of *patterns* and *cause and effec*t are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency *in analyzing and interpreting data*, *constructing explanations*, and *designing solutions*. Students are also expected to use these practices to demonstrate understanding of the core ideas.

This unit is based on 3-LS3-1 and 3-LS3-2.

New Jersey Student Learning Standards/Student Learning Objectives

Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms. *[Clarification Statement: Patterns are the similarities and differences in traits shared between offspring and their parents, or among siblings. Emphasis is on organisms other than humans.] [Assessment Boundary: Assessment does not include genetic mechanisms of inheritance and prediction of traits. Assessment is limited to non-human examples.]* **(3-LS3-1)**

Use evidence to support the explanation that traits can be influenced by the environment. *[Clarification Statement: Examples of the environment affecting a trait could include normally tall plants grown with insufficient water are stunted; and, a pet dog that is given too much food and little exercise may become overweight.]* **(3-LS3-2)**

Benchmark Assessment:

Unit Sequence	
Part A: *What kinds of traits are passed on from parent to offspring?*	
Concepts	**Formative Assessment**
• Similarities and differences in patterns can be used to sort and classify natural phenomena (e.g., inherited traits that occur naturally). • Many characteristics of organisms are inherited from their parents. • Different organisms vary in how they look and function because they have different inherited information.	*Students who understand the concepts are able to:* • Sort and classify natural phenomena using similarities and differences. *(Clarification: Patterns are the similarities and differences in traits shared between offspring and their parents or among siblings, with an emphasis on organisms other than humans).* • Analyze and interpret data to make sense of phenomena using logical reasoning. • Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms. *(Assessment does not include genetic mechanisms of inheritance and prediction of traits, and is limited to nonhumans.)*

Unit Sequence	
Part B: *What environmental factors might influence the traits of a specific organism?*	
Concepts	**Formative Assessment**
• Cause-and-effect relationships are routinely identified and used to explain change. • Other characteristics, which can range from diet to learning, result from individuals' interaction with the environment. • Many characteristics involve both inheritance and environment. • The environment also affects the traits that an organism develops.	*Students who understand the concepts are able to:* • Identify cause-and-effect relationships in order to explain change. • Use evidence (e.g., observations, patterns) to support an explanation. • Use evidence to support the explanation that traits can be influenced by the environment. Examples of the environment's effect on traits could include: ✓ Normally tall plants that grow with insufficient water are stunted. ✓ A pet dog that is given too much food and little exercise may become overweight.

What It Looks Like in the Classroom
Scientists sort and classify organisms based on similarities and differences in characteristics or traits. Students can easily observe external traits of animals such as body coverings; type, shape, and number of external features; and type, shape, and color of eyes. Similarly, they can observe external traits of plants such as the type of root system or the shape, color, and average size of leaves. The characteristics that organisms inherit influence how they look and how they function within their environment. As students observe parents and their offspring, they will notice that parents and offspring share many traits. As they observe a larger number of organisms from the same group, they will notice similarities and differences in the traits of individuals within a group. Students can observe similarities and differences in the traits of organisms and use these observations as evidence to support the idea that offspring inherit traits from parents, but these traits do vary within a group of similar organisms. Sometimes, variations among organisms within a group are due to fact that individuals inherit traits from different parents. However, traits can also be influenced by an individuals' interaction with the environment. For example, all lions have the necessary inherited traits that allow them to hunt, such as sharp claws, sharp teeth, muscular body type, and speed. However, being a successful hunter also depends on the interaction that individual lions have with their parents and their environment. A lion cub raised in captivity without parents will have the same type of claws, teeth, and muscular body as all other lions, but it may never have the opportunity to learn to use its traits to hunt. Additionally, the environment can affect an organism's physical development. For example, any plant that lacks sufficient nutrients or water will not thrive and grow as it should. It will most likely be smaller in size, have fewer leaves, and may even look sickly. Likewise, too much food and lack of exercise can result in an overweight dog. To investigate how the environment influences traits, students can plant the same type of seedling in different locations, which will provide variations of light, water, or soil. Data can be collected about rates of growth, height, and heartiness of the plant. The information gathered can be analyzed to provide evidence as to how the environment influenced the traits of the plant. As students read about, observe, and discuss these ideas, they learn that even though every organism inherits particular traits from its parents, the environment can have a marked effect on those traits and the development of others

Connecting with English Language Arts/Literacy and Mathematics

English Language Arts

In order to integrate the New Jersey Student Learning Standards for English language arts, students will need opportunities to read about inherited traits of animals and plants in a variety of texts and resources. During discussions, teachers might pose questions such as "What kinds of traits are passed on from parent to offspring?" or "What environmental factors might influence the traits of a specific organism?" Students should be able to refer specifically to the text when answering questions, articulate the main idea, and describe the key ideas using supporting details in their explanations. Additionally, they should describe the relationship between scientific ideas or concepts, using language that pertains to time, sequence, and cause and effect.

During this unit, students also need opportunities to write informative/explanatory texts to convey ideas and information gathered through investigations and from other resources. For example, after reading texts about a given organism, students should be expected to use key details and appropriate facts about that organism to compose an informative piece of writing. This piece should list some of the organism's traits that were passed on from its parents, describe how those traits enable the organism to interact in its environment to meet its needs, and describe any influence the environment has on the organism's traits. Students should also have the opportunity to report orally on a given topic related to traits and the way they are influenced by the environment. They should share relevant facts, details, and information while speaking clearly and at an understandable pace.

Mathematics

This unit also has connections to the New Jersey Student Learning Standards for mathematics. Students can use rulers to measure the growth of organisms, then generate and plot the data they collected on line plots, making sure the horizontal scale is marked off in appropriate units (whole numbers, halves, or quarters). For example, students might chart out data in line plots to document the growth (over time) of each of a number of plants grown from a single parent. As students analyze their data, they will observe that the offspring are not the same exact height as each other or as the parent, but that the height of all plants is very similar when the plants are grown under the same conditions. Students might also make similar line plots to compare the same type of plants grown with varying amounts of water or sunlight, then compare these data to the growth data of the parent plant. Analyzing this data will help students understand that environmental factors influence/affect the traits of organisms. As students collect, organize, and analyze their data, they have opportunities to reason abstractly and model with mathematics.

Modifications	
Special Education: • Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community. • Provide students with multiple choices for how they can represent their understandings (e.g. multi-sensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling). • Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies). • Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences). • Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings. • Teacher models • Show additional number of samples/examples • Provide additional opportunities to practice • Use re-teaching and/or restating to address student's needs • Use small group table conferences to address needs • Develop target vocabulary • Scaffold comprehension when reading is necessary to fully understand science concept(s) • Use graphic organizers to develop key concepts/ideas • Teach key aspects of a topic and eliminate nonessential information.	**English Language Learners (ELLs):** ● Model Thinking Aloud ● Encourage Partner Talk ● Repeat and Clarify ● Provide a Sequence ● Encourage self-selection of topics ● Target vocabulary ● Scaffold comprehension when reading is used to promote reader response ● Scaffold content-literacy reading ● Allow products to demonstrate student's learning ● Provide on-going feedback

Students at Risk of School Failure:	**Gifted Students:**
● Build a relationship ● Allow flexible due dates ● Employ strategies from *"Classroom Instruction that Works"* ● Create the Opportunity to Learn strategies ● Build lessons around student interests	• Utilize flexible groups-group gifted students with other gifted students or higher-level learners • Encourage students to explore/research concepts in depth via independent studies or investigations (individual/group) • Differentiate product assignments. Employ differentiated curriculum to keep interest/motivation high • Encourage creative expression and thinking by allowing students to choose how to approach a problem or assignment (problem based learning) • Invite students to explore different points of view on a topic of study and compare the two • Provide multiple opportunities for students to "Own Their Learning" • Ask students higher-level questions that require students to look into causes, experiences, and facts to draw a conclusion to other areas of learning. (Webb's Depth of Knowledge- Level 4) • Create a room environment that encourages creativity and discovery through the use of interesting literature and reference materials. Supply reading materials on a wide variety of subjects and levels • Provide a learning-rich environment that includes a variety of resources, media, tasks, and methods of teaching •

Prior Learning
By the end of Grade 1, students understand that: • Young animals are very much, but not exactly like, their parents. Plants also are very much, but not exactly, like their parents. • Individuals of the same kind of plant or animal are recognizable as similar but can also vary in many ways.

Future Learning
By the end of middle school, students will understand that: • Animals engage in characteristic behaviors that increase the odds of reproduction. • Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction. • Genetic factors as well as local conditions affect the growth of the adult plant. • Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring. • Genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes. Each distinct gene chiefly controls the production of specific proteins, which in turn affect the traits of the individual. Changes (mutations) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits. • Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited. • In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals have two of each chromosome and hence two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other. • In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations. Though rare, mutations may result in changes to the structure and function of proteins. Some changes are beneficial, others are harmful, and some are neutral to the organism.

Appendix A: NGSS and Foundations for the Module		
Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms. *[Clarification Statement: Patterns are the similarities and differences in traits shared between offspring and their parents, or among siblings. Emphasis is on organisms other than humans.] [Assessment Boundary: Assessment does not include genetic mechanisms of inheritance and prediction of traits. Assessment is limited to non-human examples.]* **(3-LS3-1)**		
Use evidence to support the explanation that traits can be influenced by the environment. *[Clarification Statement: Examples of the environment affecting a trait could include normally tall plants grown with insufficient water are stunted; and, a pet dog that is given too much food and little exercise may become overweight.]* **(3-LS3-2)**		
The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:		
Science and Engineering Practices	**Disciplinary Core Ideas**	**Crosscutting Concepts**
Analyzing and Interpreting Data • Analyze and interpret data to make sense of phenomena using logical reasoning. (3-LS3-1) **Constructing Explanations and Designing Solutions** • Use evidence (e.g., observations, patterns) to support an explanation. (3-LS3-2) ▪	**LS3.A: Inheritance of Traits** • Many characteristics of organisms are inherited from their parents. (3-LS3-1) • Other characteristics result from individuals' interactions with the environment, which can range from diet to learning. Many characteristics involve both inheritance and environment. (3-LS3-2) **LS3.B: Variation of Traits** • Different organisms vary in how they look and function because they have different inherited information. (3-LS3-1) • The environment also affects the traits that an organism develops. (3-LS3-2)	**Patterns** • Similarities and differences in patterns can be used to sort and classify natural phenomena. (3-LS3-1) **Cause and Effect** • Cause and effect relationships are routinely identified and used to explain change. (3-LS3-2)

English Language Arts	Mathematics
Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers. (3-LS3-1),(3-LS3-2) **RI.3.1** Determine the main idea of a text; recount the key details and explain how they support the main idea. (3-LS3-1),(3-LS3-2) **RI.3.2** Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect. (3-LS3-1),(3-LS3-2) **RI.3.3** Write informative/explanatory texts to examine a topic and convey ideas and information clearly. (3-LS3-1),(3-LS3-2),(3-LS4-2) **W.3.2** Report on a topic or text, tell a story, or recount an experience with appropriate facts and relevant, descriptive details, speaking clearly at an understandable pace. (3-LS3-1),(3-LS3-2) **SL.3.4**	Reason abstractly and quantitatively. (3-LS3-1),(3-LS3-2) **MP.2** Model with mathematics. (3-LS3-1),(3-LS3-2) **MP.4** Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units—whole numbers, halves, or quarters. (3-LS3-1),(3-LS3-2) **3.MD.B.4**

Module #3b "Traits and Continuing the Life Cycle" (TCI's Science Alive! Unit #4 "Life Cycles and Traits"

Do all living things have the same life cycle?

Are there advantages to being different?

In this unit of study, students develop an understanding of the similarities and differences in organisms' life cycles. In addition, students use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing. The crosscutting concepts of *patterns* and *cause and effect* are called out as organizing concepts for these disciplinary core ideas. Students demonstrate grade-appropriate proficiency in *developing and using models and constructing explanations and designing solutions*. Students are also expected to use these practices to demonstrate understanding of the core ideas.

This unit is based on 3-LS1-1 and 3-LS4-2.

New Jersey Student Learning Standards/Student Learning Objectives

Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death. *[Clarification Statement: Changes organisms go through during their life form a pattern.] [*Assessment Boundary: Assessment of plant life cycles is limited to those of flowering plants. Assessment does not include details of human reproduction.*]* **(3-LS1-1)**

Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing. *[Clarification Statement: Examples of cause and effect relationships could be plants that have larger thorns than other plants may be less likely to be eaten by predators; and, animals that have better camouflage coloration than other animals may be more likely to survive and therefore more likely to leave offspring.]* **(3-LS4-2)**

Unit Sequence	
Part A: *Do all living things have the same life cycle?*	
Concepts	**Formative Assessment**
• Science findings are based on recognizing patterns. • Similarities and differences in patterns can be used to sort and classify natural phenomena. • Patterns of change can be used to make predictions. • Reproduction is essential to the continued existence of every kind of organism. • Plants and animals have unique and diverse life cycles.	*Students who understand the concepts are able to:* • Sort and organisms (inherited traits) using similarities and differences in patterns. • Make predictions using patterns of change. • Develop models to describe phenomena. • Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death. (I.e., Changes organisms go through during their life form a pattern.) *(Assessment of plant life cycles is limited to those of flowering plants. Assessment does not include details of human reproduction.)*

Unit Sequence	
Part B: *Are there advantages to being different?*	
Concepts	**Formative Assessment**
• Cause-and-effect relationships are routinely identified and used to explain change. • Sometimes the differences in characteristics between individuals of the same species provide advantages in surviving, finding mates, and reproducing.	*Students who understand the concepts are able to:* • Identify cause-and-effect relationships in order to explain change. • Use evidence (e.g., observations, patterns) to construct an explanation. • Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing. Examples of cause-and-effect relationships could include: ✓ Plants that have larger thorns than other plants may be less likely to be eaten by predators. ✓ Animals that have better camouflage coloration than other animals may be more likely to survive and therefore more likely to leave offspring.

What It Looks Like in the Classroom
In third grade, students learn that the changes an organism goes through during its life form an observable pattern. Although different types of organisms have unique and diverse life cycles, they follow a pattern of birth, growth, reproduction, and death. While observing and studying life cycles, students should look closely for patterns of change and use these observed patterns to make predictions. They should also sort and classify a variety of organisms using the similarities and differences they observe. For example, flowering plants begin as seeds. With the right conditions, the seeds germinate and grow, from small seedlings to adult plants. Adult plants then produce flowers that, once pollinated, will produce seeds from which the next generation will grow. Animals, likewise, go through observable patterns of change, which allow students to sort and classify them based on the stages of their life cycles. Some animals, for example, undergo complete metamorphosis; others go through incomplete metamorphosis; while others do not undergo metamorphosis at all. Some animals begin their life cycles with a live birth, while others hatch from eggs. Students should develop models to describe the unique and diverse life cycles of organisms. They can draw diagrams, build physical models, or create presentations to show the patterns of change that make up the life cycles of given organisms. As students become familiar with the stages in the life cycles of different types of plant and animals, they will come to understand that reproduction is essential to the continued existence of every kind of organism. In prior learning, students learned that organisms have traits that are inherited from their parents. This process occurs during reproduction. While observing and identifying traits of a specific species or type of organism, students also learned that there are differences in characteristics within the same species. In this unit, students learn that these differences in characteristics among individuals of the same species sometimes provide advantages in survival, finding mates, and reproducing. For example, when comparing plants from the same species, those with larger or more abundant thorns may be less likely to be eaten by a predator. Likewise, animals with better camouflage coloration may be more likely to survive and therefore more likely to leave offspring. As students read about, observe, and discuss variations in organisms' characteristics, they should identify cause-and-effect relationships that help explain why any variation might give an advantage in surviving or reproducing to some members of a species over others.

Connecting with English Language Arts/Literacy and Mathematics

English Language Arts

Students need opportunities to read about the life cycles and inherited traits of organisms in a variety of texts and resources. During discussions, teachers might pose questions such as

- ✓ What are the stages of an organism's life cycle?
- ✓ How do the life cycles of organisms compare?
- ✓ What makes an organism's life cycle unique?
- ✓ How do organisms use their characteristics to survive, find mates, and reproduce?

Students need access to a variety of books, pictures, and maps. They should be able to refer to these resources specifically when answering questions, articulating the main idea, and describing the key ideas using supporting details in their explanations. Additionally, they should describe the relationship between scientific ideas or concepts and using language that pertains to time, sequence, and cause and effect.

Students also need opportunities to write informative/explanatory texts to convey ideas and information gathered through investigations and from other resources. For example, after reading texts about a given organism, students should be expected to use key details and appropriate facts about that organism to compose an informative piece of writing that lists some of the organism's traits that might give it an advantage in survival, growth, or reproduction over others of its kind. Students can also use Venn diagrams or T-charts to compare traits among individuals from a common species. These data can be used to explain how variations in characteristics can give an advantage to one or another individual in reproduction, growth, or survival. Students should also have the opportunity to report on how one or more traits of an organism give it an advantage in survival, growth, and/or reproduction in its environment. As students speak, they should share relevant facts, details, and information while speaking clearly and at an understandable pace.

Mathematics

Students can draw scaled picture graphs or bar graphs to represent a data set with several categories, such as the average length of the life span of a variety of organisms, which could range from days to hundreds of years, or the varying reproductive capacity of organisms, which could range from a single offspring to thousands. As students analyze their data, they may observe similarities within a category of organisms (e.g., mammals, reptiles, or insects) or marked differences across these same categories. Analyzing data will help students understand that organisms have unique and diverse life cycles, but all have in common birth, growth, reproduction, and death. As students collect, organize, and analyze their data, they have opportunities to reason abstractly and model with mathematics.

Modifications	
Special Education: • Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community. • Provide students with multiple choices for how they can represent their understandings (e.g. multi-sensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling). • Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies). • Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences). • Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings. • Teacher models • Show additional number of samples/examples • Provide additional opportunities to practice • Use re-teaching and/or restating to address student's needs • Use small group table conferences to address needs • Develop target vocabulary • Scaffold comprehension when reading is necessary to fully understand science concept(s) • Use graphic organizers to develop key concepts/ideas • Teach key aspects of a topic and eliminate nonessential information.	**English Language Learners (ELLs):** • Model Thinking Aloud • Encourage Partner Talk • Repeat and Clarify • Provide a Sequence • Encourage self-selection of topics • Target vocabulary • Scaffold comprehension when reading is used to promote reader response • Scaffold content-literacy reading • Allow products to demonstrate student's learning • Provide on-going feedback

Students at Risk of School Failure:	**Gifted Students:**
● Build a relationship ● Allow flexible due dates ● Employ strategies from *"Classroom Instruction that Works"* ● Create the Opportunity to Learn strategies ● Build lessons around student interests	• Utilize flexible groups-group gifted students with other gifted students or higher-level learners • Encourage students to explore/research concepts in depth via independent studies or investigations (individual/group) • Differentiate product assignments. Employ differentiated curriculum to keep interest/motivation high • Encourage creative expression and thinking by allowing students to choose how to approach a problem or assignment (problem based learning) • Invite students to explore different points of view on a topic of study and compare the two • Provide multiple opportunities for students to "Own Their Learning" • Ask students higher-level questions that require students to look into causes, experiences, and facts to draw a conclusion to other areas of learning. (Webb's Depth of Knowledge- Level 4) • Create a room environment that encourages creativity and discovery through the use of interesting literature and reference materials. Supply reading materials on a wide variety of subjects and levels • Provide a learning-rich environment that includes a variety of resources, media, tasks, and methods of teaching

Prior Learning
Grade 1 Unit 2: Characteristics of Living Things • Individuals of the same kind of plant or animal are recognizable as similar but can also vary in many ways.

Future Learning
Grade 6 Unit 1: Growth, Development, and Reproduction of Organisms • Animals engage in characteristic behaviors that increase the odds of reproduction. • Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction. • Genetic factors as well as local conditions affect the growth of the adult plant. **Grade 6 Unit 2: Matter and Energy in Organisms and Ecosystems** • Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. • In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction. • Growth of organisms and population increases are limited by access to resources. • Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared. **Grade 7 Unit 6: Inheritance and Variation of Traits** • In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals have two of each chromosome and hence two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other.

- In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations. Though rare, mutations may result in changes to the structure and function of proteins. Some changes are beneficial, others harmful, and some neutral to the organism.

Grade 8 Unit 2: Selection and Adaptation

- Natural selection leads to the predominance of certain traits in a population, and the suppression of others.
- In artificial selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed on to offspring.

Appendix A: NGSS and Foundations for the Module		
Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death. *[Clarification Statement: Changes organisms go through during their life form a pattern.]* [Assessment Boundary: Assessment of plant life cycles is limited to those of flowering plants. Assessment does not include details of human reproduction.*]* **(3-LS1-1)**		
Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing. *[Clarification Statement: Examples of cause and effect relationships could be plants that have larger thorns than other plants may be less likely to be eaten by predators; and, animals that have better camouflage coloration than other animals may be more likely to survive and therefore more likely to leave offspring.]* **(3-LS4-2)**		
The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:		
Science and Engineering Practices	**Disciplinary Core Ideas**	**Crosscutting Concepts**
Developing and Using Models • Develop models to describe phenomena. (3-LS1-1) **Constructing Explanations and Designing Solutions** • Use evidence (e.g., observations, patterns) to construct an explanation. (3-LS4-2)	**LS1.B: Growth and Development of Organisms** • Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles. (3-LS1-1) **LS4.B: Natural Selection** • Sometimes the differences in characteristics between individuals of the same species provide advantages in surviving, finding mates, and reproducing. (3-LS4-2)	**Patterns** • Patterns of change can be used to make predictions. (3-LS1-1) **Cause and Effect** • Cause and effect relationships are routinely identified and used to explain change. (3-LS4-2),(3-LS4-3) - ***Connections to Nature of Science*** **Scientific Knowledge is Based on Empirical Evidence** • Science findings are based on recognizing patterns. (3-LS1-1)

English Language Arts	Mathematics
Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers. (3-LS4-2) **RI.3.1** Determine the main idea of a text; recount the key details and explain how they support the main idea. (3-LS4-2) **RI.3.2** Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect. (3-LS4-2) **RI.3.3** Use information gained from illustrations (e.g., maps, photographs) and the words in a text to demonstrate understanding of the text (e.g., where, when, why, and how key events occur). (3-LS1-1) **RI.3.7** Report on a topic or text, tell a story, or recount an experience with appropriate facts and relevant, descriptive details, speaking clearly at an understandable pace. (3-LS4-2) **SL.3.4** Create engaging audio recordings of stories or poems that demonstrate fluid reading at an understandable pace; add visual displays when appropriate to emphasize or enhance certain facts or details. (3-LS1-1) **SL.3.5** Write informative/explanatory texts to examine a topic and convey ideas and information clearly. (3-LS4-2) **W.3.2**	Reason abstractly and quantitatively. (3-LS4-2) **MP.2** Model with mathematics. (3-LS1-1), (3-LS4-2) **MP.4** Number and Operations in Base Ten (3-LS1-1) **3.NBT** Number and Operations—Fractions (3-LS1-1) **3.NF** Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using information presented in scaled bar graphs. (3-LS4-2) **3.MD.B.3** Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units—whole numbers, halves, or quarters. (3-LS4-1) **3.MD.B.4**

Module #3 "Traits and Continuing the Life Cycle" *(TCI's Science Alive! Unit #4 "Life Cycles and Traits")*
Core Lesson #1 *"Why Do Offspring Look Similar to Their Parents?"*

Essential Question(s):

- Why do offspring look similar to their parents?

Objectives	NJSLS Standard(s)	Segment	Time	Instructional Plan/Materials
SWBAT: • Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms • Understand that many characteristics of organisms are inherited from parents • Understand that different organisms vary in how they look and function because they have different inherited information • Recognize that similarities and differences in patterns can be used to sort and	3.LS3.1 LS3.A LS3.B RI.3.1	*Introduction/ Anticipatory Set*	- one 48 minute class period	• Slide presentation for Lesson 1 – show Slide #6 and discuss • Complete Interactive Student Notebook (ISN) pg. 187 • Read student textbook pgs. 220-227 and discuss • Complete ISN pgs. 188-191 "Reading Notes"
		Activity	- two 48 minute class periods	• Investigation: Show Slide Presentation (Slides 7-22) for group activities (Handouts A-C) and discussion • For Slide #15 and Slide #22 complete ISN pgs. 192-193
		Evaluation/ Assessment	- one 48 minute class period	• Review/Conclusions – Slides #23-25 • Complete ISN pg. 194 and discuss • Extension Activity – Reading Further "The Cutest Baby Face" pgs. 228-251

classify natural phenomena • Analyze and interpret data to make sense of phenomena using logical reasoning				
Key Vocabulary: • Inherited trait • Offspring • Species • trait				

Module #3 "Traits and Continuing the Life Cycle" *(TCI's Science Alive! Unit #4 "Life Cycles and Traits")*
Core Lesson #2 *"How Does the Environment Affect Traits?"*

Essential Question(s):

- How does the environment affect traits?

Objectives	NJSLS Standard(s)	Segment	Time	Instructional Plan/Materials
SWBAT: • Use evidence to support the explanation that traits can be influenced by the environment • Understand that other characteristics result from individuals' interactions with the environment ranging from diet to learning • Understand the environment also affects the traits that an organism develops • Recognize that cause and effect relationships are routinely identified and used to explain change • Use evidence (observations, patterns) to support an explanation	3.LS3.2 LS3.A LS3.B RI,3,3 W.3.2	*Introduction/ Anticipatory Set*	- one 48 minute class period	• Slide presentation for Lesson 2 – show Slide #6 and discuss • Complete Interactive Student Notebook (ISN) pg. 195 • Read student textbook pgs. 232-237 and discuss • Complete ISN pgs. 196-198 "Reading Notes" "Reading Notes"
		Activity	- two 48 minute class periods	• Investigation: Show Slide Presentation (Slides 7-18) for group activities (Handouts A-C) and discussion • For Slide #12, Slide #15, and Slide #18 complete ISN pgs. 199-201
		Evaluation/ Assessment	- one 48 minute class period	• Review/Conclusions – Slides #19-21 • Complete ISN pg. 202 and discuss • Extension Activity – Reading Further "Animal Commuters" student textbook pgs. 238-241

Key Vocabulary:

- Environment
- Learned behavior

Module #3 "Traits and Continuing the Life Cycle" *(TCI's Science Alive! Unit #4 "Life Cycles and Traits")*
Core Lesson #3 *"How Are Traits Affected by Both Inheritance and the Environment?"*

Essential Question(s):

- How are traits affected by both inheritance and the environment?

Objectives	NJSLS Standard(s)	Segment	Time	Instructional Plan/Materials
SWBAT: • Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms • Use evidence to support the explanation that traits can be influenced by the environment • Understand that many characteristics of organisms are inherited from parents • Understand that other characteristics of organisms result from individuals' interactions with the environment, which can range from diet to learning	3.LS3.1 3.LS3.2 LS3.A LS3.B RI.3.3 RI.3.7 W.3.2	*Introduction/ Anticipatory Set*	- one 48 minute class period	• Slide presentation for Lesson 3 – show Slide #6 and discuss • Complete Interactive Student Notebook (ISN) pg. 203 • Read student textbook pgs. 242-247 and discuss • Complete ISN pgs. 204-206 "Reading Notes"
		Activity	- two 48 minute class periods	• Investigation: Show Slide Presentation (Slides 19-22) for group activities (Handout A) and discussion • Show videos for Slides #14 & 19 • For Slide #13, Slide #18 and Slide #20 complete ISN pgs. 207-209
		Evaluation/ Assessment	- one 48 minute class period	• Review/Conclusions – Slides #23-25 • Complete ISN pg. 210 and discuss • Extension Activity – Reading Further "So You Want to Get a Puppy" pgs. 248-251

• Understand that different organisms vary in how they look and function because they have different inherited information • Understand the environment also affects the traits that an organisms develops				
Key Vocabulary: • Genes				

Module #3 "Traits and Continuing the Life Cycle" *(TCI's Science Alive! Unit #4 "Life Cycles and Traits")*
Core Lesson #4 *"Why Do Some Members of a Species Survive and Not Others?"*

Essential Question(s):

- Why do some members of a species survive and not others?

Objectives	NJSLS Standard(s)	Segment	Time	Instructional Plan/Materials
SWBAT: • Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing • Understand that sometimes the differences in characteristics between individuals of the same species provide advantages in surviving, finding mates, and reproducing • Recognize that cause and effect relationships are routinely identified and	3.LS4.2 LS4.B RI.3.1 R1.3.2 W.3.2	*Introduction/ Anticipatory Set*	- one 48 minute class period	• Slide presentation for Lesson 4 – show video Slide #6 to students • Slide presentation for Lesson 4 – show Slide #8 and discuss same • Complete Interactive Student Notebook (ISN) pg. 211 • Read student textbook pgs. 252-259 and discuss • Complete ISN pgs. 217-219 "Reading Notes"
		Activity	- two 48 minute class periods	• Investigation: Show Slide #9 to gather materials necessary for the Investigation • Show Slides #10 – #17 Preparing for the Simulation and Investigation • Record data and analyze same in the ISN pgs. 212-214 • Show videos for Slides #14 & 19

used to explain change • Use evidence (observations, patterns) to construct an explanation		*Evaluation/ Assessment*	- one 48 minute class period	• Review/Conclusions – Slides #18-20 • Complete ISN pg. 218 and discuss same • Extension Activity – Reading Further "Animal Spy Cameras" pgs. 260-263
Key Vocabulary: • Camouflage • Mate • Reproduce • Survive				

Module #3 "Traits and Continuing the Life Cycle" *(TCI's Science Alive! Unit #4 "Life Cycles and Traits")*
Core Lesson #5 *"What are the Life Cycles of Plants?"*

Essential Question(s):

- What are the life cycles of plants?

Objectives	NJSLS Standard(s)	Segment	Time	Instructional Plan/Materials
SWBAT: • Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death • Understand that reproduction is essential to the continued existence of every kind of organism. • Recognize that plants and animals have unique and diverse life cycles • Recognize that patterns of change can be used to make predictions • Develop models to describe phenomena • Communicate scientific and/or technical information orally and/or in written formats	3.LS1.1 LS1.B RI.3.7	*Introduction/ Anticipatory Set*	- one 48 minute class period	• Slide presentation for Lesson 5 – show Slide #6 and discuss same • Complete Interactive Student Notebook (ISN) pg. 219 • Read student textbook pgs. 264-269 and discuss • Complete ISN pgs. 221-225 "Reading Notes"
		Activity	- two 48 minute class periods	• Investigation: Show Slide #7 to gather materials necessary for the Investigation • Investigation - Show Slides #10 – #18 and play the videos for Slides 10, 12, 11, 13, 14 • Record data and analyze same in the ISN pgs. 220-222
		Evaluation/ Assessment	- one 48 minute class period	• Review/Conclusions – Slides #19-21 • Complete ISN pg. 226 and discuss same • Extension Activity – Reading Further "Getting Into the

including various forms of media as well as tables, diagrams, and charts				Treetops" pgs. 270-271
Key Vocabulary: • Flower • Fruit • Life cycle • Life span • Seed				

Module #3 "Traits and Continuing the Life Cycle" *(TCI's Science Alive! Unit #4 "Life Cycles and Traits")*
Core Lesson #6 *"What are the Life Cycles of Animals With Backbones?"*

Essential Question(s):

- What are the life cycles of animals with backbones?

Objectives	NJSLS Standard(s)	Segment	Time	Instructional Plan/Materials
SWBAT: • Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death • Understand that reproduction is essential to the continued existence of every kind of organism. • Recognize that plants and animals have unique and diverse life cycles • Recognize that patterns of change can be used to make predictions • Develop models to describe phenomena • Communicate scientific and/or technical	3.LS1.1 LS1.B RI.3.3 SL.3.5	*Introduction/ Anticipatory Set*	- one 48 minute class period	• Slide presentation for Lesson 6 – show Slide #6 and discuss same • Complete Interactive Student Notebook (ISN) pg. 227 • Read student textbook pgs.272-279 and discuss • Complete ISN pgs. 228-230 "Reading Notes"
		Activity	- four 48 minute class periods	• Investigation (Virtual Discovery): Show Slides #7 – 25. Students will be working in groups. Videos will be played and notetaking will occur (Handouts A & B – one per student) • Record data and analyze same in the ISN pgs.231-233 • Groups will take turns sharing/presenting different ways vertebrates went through each of the life cycles stages

information orally and/or in written formats including various forms of media as well as tables, diagrams, and charts		*Evaluation/ Assessment*	- one 48 minute class period	• Review/Conclusions – Slides #26-28 • Complete ISN pg. 234 and discuss same • Extension Activity – Reading Further "A Passion for Chimps" pgs. 280-283
Key Vocabulary: • Metamorphosis • Vertebrate				

Module #3 "Traits and Continuing the Life Cycle" *(TCI's Science Alive! Unit #4 "Life Cycles and Traits")*
Core Lesson #7 *"What are the Life Cycles of Animals Without Backbones?"*

Essential Question(s):

- What are the life cycles of animals without backbones?

Objectives	NJSLS Standard(s)	Segment	Time	Instructional Plan/Materials
SWBAT: • Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death • Understand that reproduction is essential to the continued existence of every kind of organism. • Recognize that plants and animals have unique and diverse life cycles • Recognize that patterns of change can be used to make predictions • Develop models to describe phenomena • Communicate scientific and/or technical	3.LS1.1 LS1.B RI.3.3	*Introduction/ Anticipatory Set*	- one 48 minute class period	• Share Slide #7 (Video) with students to prepare for the Investigation (caring for butterflies and observing the butterfly life cycle) • Slide presentation for Lesson 7– show Slide #9 and discuss same • Complete Interactive Student Notebook (ISN) pg. 235 • Read student textbook pgs.284-291 and discuss • Complete ISN pgs. 236-239 "Reading Notes"
		Activity	- two 48 minute class periods (6-8 weeks of observations for butterflies)	• Investigation: Show Slides #10 – 29. Students will be regularly observing their butterfly larva and butterflies (Painted Ladies) throughout this Lesson (6-8 weeks) • Record data and analyze same in the ISN pgs.240-241

information orally and/or in written formats including various forms of media as well as tables, diagrams, and charts		*Evaluation/ Assessment*	- one 48 minute class period	• Review/Conclusions – Slides #30-32 • Complete ISN pg. 242 and discuss same • Extension Activity – Reading Further "Immortal Jellyfish" pgs. 292-293
Key Vocabulary: • Exoskeleton • Invertebrate • Larva • Nymph				

Module #4a "Organisms and the Environment" (CBBS "Life in Ecosystems Kit")

Why don't we see alligators in the arctic?

In this unit of study, students develop an understanding of the idea that when the environment changes, some organisms survive and reproduce, some move to new locations, some move into the transformed environment, and some die. The crosscutting concepts of *cause and effect* and the *interdependence of science, engineering, and technology* are called out as organizing concepts for these disciplinary core ideas. Students demonstrate grade-appropriate proficiency in *engaging in argument from evidence*. Students are also expected to use this practice to demonstrate understanding of the core ideas.

This unit is based on 3-LS2-1 and 3-LS4-3.

New Jersey Student Learning Standards/Student Learning Objectives

Construct an argument that some animals form groups that help members survive. (3-LS2-1)

Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all. *[Clarification Statement: Examples of evidence could include needs and characteristics of the organisms and habitats involved. The organisms and their habitat make up a system in which the parts depend on each other.]* **(3-LS4-3)**

Benchmark Assessment:

"Summative Assessment" TG Appendix F pg. 101-102

Unit Sequence	
Part A: *In a particular habitat, why do some organisms survive well, some survive less well, and some not survive at all?*	
Concepts	**Formative Assessment**
• Cause-and-effect relationships are routinely identified and used to explain change. • Knowledge of relevant scientific concepts and research findings is important in engineering. • For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all. • Organisms and their habitat make up a system in which the parts depend on each other.	*Students who understand the concepts are able to:* • Identify cause-and-effect relationships in order to explain change. • Construct an argument with evidence. • Construct an argument with evidence (e.g., needs and characteristics of the organisms and habitats involved) that in a particular habitat, some organisms can survive well, some can survive less well, and some cannot survive at all.

What It Looks Like in the Classroom
Organisms and their habitats make up a system in which they are interdependent. Environmental factors affect the growth and survival of every type of organism, and organisms in turn affect the environment. The focus of this unit of study is identifying cause-and-effect relationships between the environment and organisms' ability to survive and reproduce. In this unit, students first learn that all organisms have a variety of behaviors and traits that enable them to survive. One of these behaviors includes forming groups. Groups serve different functions and can vary dramatically in size. Animals may form groups to obtain food, to defend themselves, and/or to cope with changes in their environment. Students should have opportunities to conduct research on animals that form groups in order to understand how being part of a group is beneficial to survival and reproduction. Students might begin with studying animals that are indigenous to the local environment (e.g., squirrels, coyotes, deer, birds, or fish), and then investigate other animals of interest, such as (but not limited to) lions, sea turtles, or penguins. For each animal that is studied, students should identify the social structure of the group and how this structure supports individuals in their need to obtain food, defend themselves, and reproduce. Topics to focus on might be the roles of males and females within a group as well as the interactions between parents and offspring. For example, within some groups of animals, the offspring leave the nest or pack early while others remain for longer periods of time. Those that stay within the group for longer periods of time may do so because of the benefits provided by the group structure. As students compare group structures of different animals and the functions that define each, they should also think about how the size of the group and the roles of individuals within the group affect the animals' overall ability to obtain food, defend themselves, and reproduce. Students will construct arguments with evidence, using cause-and-effect relationships to show why some animals form groups and how this is advantageous to survival and reproduction. In this unit, students also learn that for any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all. As students explore the components of a given environment, they learn that each environment has a particular climate as well as finite sources of water and space. Each environment will support organisms (both plants and animals) with structures and behaviors that are best suited to the climate and resources available. Students will need opportunities to investigate the organisms (plants and animals) that live in certain environments and determine what traits and behaviors allow these organisms to survive and reproduce in that environment. In addition, students should identify some examples of organisms that would survive less well, or not at all, in that environment, and give evidence to support their thinking. Students construct arguments with evidence, using cause-and-effect relationships, to show how the needs and characteristics of the organisms are not well suited for the given environment.

Connecting with English Language Arts/Literacy and Mathematics
English Language Arts Students need opportunities use informational text and other resources to gather information about organisms and the environments in which they live. Students should be able to ask and answer questions to demonstrate understanding of content-specific text and be able to cite evidence from the text to support their thinking. For example, after reading an article about wolves, students ask and answer questions such as: ✓ How does being a member of a pack help wolves survive? ✓ What characteristics do wolves have that enable them to survive in their environment? ✓ What characteristics and resources does the environment have that allow wolves to survive and reproduce in that environment? Students should be able to refer specifically to the text when answering questions, articulating the main idea and describing key details in their explanations. Students also need opportunities to write informative/explanatory texts and opinion pieces with supporting evidence to convey their ideas and understanding of cause-and-effect relationships between the environment and an organism's ability to survive and reproduce. For example, after reading text about a given animal, students should be expected to use key details and appropriate facts about that animal to compose an informative piece of writing that describes the animal's characteristics and behaviors that aid in its survival. Students should also have the opportunity to orally report on a given topic, sharing relevant facts and details while speaking clearly and at a reasonable pace. *Mathematics* Students can model with mathematics by graphing the average number of organisms that make up a group among a variety of species. For example, some species live in small groups of six to eight members, while others live in groups that include thousands of organisms. Students will also reason abstractly and quantitatively as they describe and compare these groups and their ability to survive and reproduce in a given environment.

Modifications	
Special Education: • Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community. • Provide students with multiple choices for how they can represent their understandings (e.g. multi-sensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling). • Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies). • Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences). • Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings. • Teacher models • Show additional number of samples/examples • Provide additional opportunities to practice • Use re-teaching and/or restating to address student's needs • Use small group table conferences to address needs • Develop target vocabulary • Scaffold comprehension when reading is necessary to fully understand science concept(s) • Use graphic organizers to develop key concepts/ideas • Teach key aspects of a topic and eliminate nonessential information.	**English Language Learners (ELLs):** • Model Thinking Aloud • Encourage Partner Talk • Repeat and Clarify • Provide a Sequence • Encourage self-selection of topics • Target vocabulary • Scaffold comprehension when reading is used to promote reader response • Scaffold content-literacy reading • Allow products to demonstrate student's learning • Provide on-going feedback

Students at Risk of School Failure:	**Gifted Students:**
● Build a relationship ● Allow flexible due dates ● Employ strategies from *"Classroom Instruction that Works"* ● Create the Opportunity to Learn strategies ● Build lessons around student interests	• Utilize flexible groups-group gifted students with other gifted students or higher-level learners • Encourage students to explore/research concepts in depth via independent studies or investigations (individual/group) • Differentiate product assignments. Employ differentiated curriculum to keep interest/motivation high • Encourage creative expression and thinking by allowing students to choose how to approach a problem or assignment (problem based learning) • Invite students to explore different points of view on a topic of study and compare the two • Provide multiple opportunities for students to "Own Their Learning" • Ask students higher-level questions that require students to look into causes, experiences, and facts to draw a conclusion to other areas of learning. (Webb's Depth of Knowledge- Level 4) • Create a room environment that encourages creativity and discovery through the use of interesting literature and reference materials. Supply reading materials on a wide variety of subjects and levels • Provide a learning-rich environment that includes a variety of resources, media, tasks, and methods of teaching

Prior Learning

Kindergarten Unit 4: Basic Needs of Living Things

- Living things need water, air, and resources from the land, and they live in places that have the things they need. Humans use natural resources for everything they do.

Grade 1 Unit 2: Characteristics of Living Things

- Adult plants and animals can have young. In many kinds of animals, parents and the offspring themselves engage in behaviors that help the offspring to survive.

Grade 2 Unit 1: Relationships in Habitats

- Plants depend on water and light to grow.
- Plants depend on animals for pollination or to move their seeds around.
- There are many different kinds of living things in any area, and they exist in different places on land and in water.

Future Learning

Grade 6 Unit 2: Matter and Energy in Organisms and Ecosystems

- Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors.
- In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction.
- Growth of organisms and population increases are limited by access to resources.
- Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared.

Grade 7 Unit 8: Earth systems

- The geologic time scale interpreted from rock strata provides a way to organize Earth's history. Analyses of rock strata and the fossil record provide only relative dates, not an absolute scale.

Grade 8 Unit 2: Selection and Adaptation

- Natural selection leads to the predominance of certain traits in a population, and the suppression of others.
- In *artificial* selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed on to offspring.

  Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes.

Appendix A: NGSS and Foundations for the Module		
Construct an argument that some animals form groups that help members survive. (3-LS2-1)		
Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all. *[Clarification Statement: Examples of evidence could include needs and characteristics of the organisms and habitats involved. The organisms and their habitat make up a system in which the parts depend on each other.]* **(3-LS4-3)**		
The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:		
Science and Engineering Practices	**Disciplinary Core Ideas**	**Crosscutting Concepts**
Engaging in Argument from Evidence • Construct an argument with evidence, data, and/or a model. (3-LS2-1) • Construct an argument with evidence. (3-LS4-3)	**LS2.D: Social Interactions and Group Behavior** • Being part of a group helps animals obtain food, defend themselves, and cope with changes. Groups may serve different functions and vary dramatically in size *(Note: Moved from K–2).* (3-LS2-1) **LS4.C: Adaptation** • For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all. (3-LS4-3)	**Cause and Effect** • Cause and effect relationships are routinely identified and used to explain change. (3-LS2-1),(3-LS4-3)

English Language Arts	Mathematics
Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers. (3-LS2-1), (3-LS4-3) **RI.3.1** Determine the main idea of a text; recount the key details and explain how they support the main idea. (3-LS4-3) **RI.3.2** Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect. (3-LS2-1),(3-LS4-3) **RI.3.3** Write opinion pieces on topics or texts, supporting a point of view with reasons. (3-LS2-1), (3-LS4-3) **W.3.1** Write informative/explanatory texts to examine a topic and convey ideas and information clearly. (3-LS4-3) **W.3.2** Report on a topic or text, tell a story, or recount an experience with appropriate facts and relevant, descriptive details, speaking clearly at an understandable pace. (3-LS4-3) **SL.3.4**	Model with mathematics. (3-LS2-1),(3-LS4-3) **MP.4** Number and Operations in Base Ten. (3-LS2-1) **3.NBT**

Module #4b "Organisms and the Environment" (CBBS "Life in Ecosystems Kit")

What do fossils tell us about the organisms and the environments in which they lived?

In this unit of study, students develop an understanding of the types of organisms that lived long ago and also about the nature of their environments. Students develop an understanding of the idea that when the environment changes, some organisms survive and reproduce, some move to new locations, some move into the transformed environment, and some die. The crosscutting concepts of *systems and system models*; *scale, proportion, and quantity*; and *the influence of engineering, technology, and science on society and the natural world* are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in *asking questions and defining problems*, *analyzing and interpreting data*, and *engaging in argument from evidence*. Students are also expected to use these practices to demonstrate understanding of the core ideas.

This unit is based on 3-LS4-1, 3-LS4-4, and 3-5-ETS1-1.

New Jersey Student Learning Standards/Student Learning Objectives

Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago. *[Clarification Statement: Examples of data could include type, size, and distributions of fossil organisms. Examples of fossils and environments could include marine fossils found on dry land, tropical plant fossils found in Arctic areas, and fossils of extinct organisms.] [*Assessment Boundary: Assessment does not include identification of specific fossils or present plants and animals. Assessment is limited to major fossil types and relative ages.*]* **(3-LS4-1)**

Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.* *[Clarification Statement: Examples of environmental changes could include changes in land characteristics, water distribution, temperature, food, and other organisms.] [*Assessment Boundary: Assessment is limited to a single environmental change. Assessment does not include the greenhouse effect or climate change.*]* **(3-LS4-4)**

Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost. (3-5-ETS1-1)

Unit Sequence	
Part A: *What do fossils tell us about the organisms and the environments in which they lived?*	
Concepts	**Formative Assessment**
• Observable phenomena exist from very short to very long periods of time. • Science assumes consistent patterns in natural systems. • Some kinds of plants and animals that once lived on Earth are no longer found anywhere. • Fossils provide evidence about the types of organisms that lived long ago, and also about the nature of their environments.	*Students who understand the concepts are able to:* • Observe that phenomena exist from very short to very long periods of time. • Analyze and interpret data to make sense of phenomena using logical reasoning. • Analyze and interpret data from fossils (e.g., type, size, distributions of fossil organisms) to provide evidence of the organisms and the environments in which they lived long ago. *(Assessment does not include identification of specific fossils or present plants and animals. Assessment is limited to major fossil types and relative ages.)* Examples of fossils and environments could include: ✓ Marine fossils found on dry land; ✓ Tropical plant fossils found in Arctic areas; or ✓ Fossils of extinct organisms.

Unit Sequence	
Part B: *What happens to the plants and animals when the environment changes?*	
Concepts	**Formative Assessment**
• A system can be described in terms of its components and their interactions. • People's needs and wants change over time, as do their demands for new and improved technologies. • Populations live in a variety of habitats, and change in those habitats affects the organisms living there. • When the environment changes in ways that affect a place's physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, others move into the transformed environment, and some die. • Possible solutions to a problem are limited by available materials and resources (constraints). • The success of a designed solution is determined by considering the desired features of a solution (criteria). • Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each	*Students who understand the concepts are able to:* • Describe a system in terms of its components and interactions. • Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of a problem. • Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change. (Assessment is limited to a single environmental change and does not include the greenhouse effect or climate change.) Examples of environmental changes could include changes in ✓ Land characteristics, ✓ Water distribution, ✓ Temperature, ✓ Food, or ✓ Other organisms. • Define a simple design problem that can be solved through the development of an object, tool, process, or system and that includes several criteria for success and constraints on materials, time, or cost. • Define a simple design problem reflecting a need or want that includes specified criteria for success and constraints on materials, time, or cost.

What It Looks Like in the Classroom

In this unit, students will study fossils or organisms that lived long ago. Students will use that understanding to make a claim about the merit of a solution to problem created by some environmental change. (Assessment is limited to one change.) Additionally, they will learn that solutions are limited by available resources (constraints), and that the success of a solution is determined by considering the desired features of a solution (criteria). This process is outlined in greater detail in the previous section.

Students gather evidence from fossils to learn about the types of organisms that lived long ago and the nature of their environments. As they learn about organisms from long ago, they come to understand that when the environment changes, some organisms survive and reproduce, some move to new locations, some move into the transformed environment, and some die.

To begin the progression of learning in this unit, students need multiple opportunities to study fossils. If actual fossils are not available, pictures and diagrams found in books and other media sources can be used. Students should observe fossils of a variety of organisms, both plant and animal, and they should observe diagrams of fossils within layers of rock. As students examine each fossil, they should be asked to identify whether the organism lived on land or in water and to give evidence to support their thinking. As students examine diagrams of fossils in layers of rock, they should be asked to identify the type of environment that existed when the layers of rock were formed. Students should consider the types of organisms that are fossilized in the rock layers in order to provide evidence to support their thinking.

If the type of environment in which the fossil was found is different from the type of environment that might have existed when the organism lived (e.g., marine fossils found on dry land, or tropical plant fossils found in Arctic areas), this would provide the opportunity to ask students to think about the types of changes that might have occurred in the environment and what effects these changes might have had on the organisms that lived in the environment as it changed over time. As students observe and analyze fossils, they learn that fossils provide evidence about the types of organisms that lived long ago and the nature of their environments. They also learn that some kinds of plants and animals that once lived on Earth are no longer found anywhere, and that this could be a result of changes that occurred in the environment.

During this unit, students also learn that populations of organisms live in a variety of habitats, and change in those habitats affects the organisms living there. When the environment changes in ways that affect a place's physical characteristics, temperature, or availability of resources, some organisms will survive and reproduce, some will move to new locations, others will move into the transformed environment, and others will die.

Students will need the opportunity to engage in a portion of the engineering design process in order to investigate the merit of solutions to problems caused when the environment changes. This process should include the following steps:

- ✓ Students brainstorm a list of environmental changes that might affect the organisms that live in the environment. This could include changes in
    - Land characteristics,

- Water distribution,
- Temperature,
- Food,
- Other organisms.

✓ As a class or in small groups, students define a problem that occurs when the environment changes. For example, if the distribution of water changes, the available water may no longer support the types of organisms that are found in the environment.

✓ As a class, determine criteria that can be used to weigh a possible solution's viability. For example, the response (solution) to the problem should not result in the extinction of a species.

✓ Small groups conduct research, using books and other reliable media sources, to determine possible solutions/ways in which organisms can solve the problem. For example, if the available water supply is no longer adequate for the organisms in the environment, there are a number of ways in which organisms respond (i.e., solve the problem); these include:

- Plants do not grow as large as before (shorter plant, smaller or fewer leaves);
- Fewer seeds germinate, thereby resulting in a smaller population;
- Herd animals may move to another environment where the water supply is adequate;
- Populations of some species may decrease, either through lower rate of reproduction or death;
- Some populations completely die out; or
- Other organisms (plants and animals) that require less water to survive may move into the environment.

✓ Students make claims about the merit of each of the various responses (solutions) by organisms based on how well the responses meet criteria; students use research data as evidence to support their thinking.

At every stage, communicating with peers is an important part of the design process. Students should identify cause-and-effect relationships throughout the process and use these relationships to explain the changes that might occur in the environment and in the populations of organisms that live there.

Connecting with English Language Arts/Literacy and Mathematics

English Language Arts

Students use content-specific print and digital sources such as books, articles, and other reliable media to observe and analyze fossils, and they use their observations to describe the types of organisms that lived in the past and characteristics of the environments in which they lived. When using these types of resources, students should determine the main idea and key details and use this information as evidence to support their thinking. They should take notes as they read and observe and use their notes as they write opinion and/or informational/explanatory pieces that convey information and ideas about organisms, both past and present, and their environments. As students discuss and write about the effects of a changing environment on organisms, they should ask and answer questions to demonstrate understanding and should cite evidence from their observations or from texts to support their thinking. Third graders should also have the opportunity to use their work to report on their findings about the effects of a changing environment on organisms living today, as well as those that lived in the past. Students should use appropriate facts and relevant descriptive details as they report out, speaking clearly at an understandable pace.

Mathematics

In order to connect the CCSS for mathematics, students generate measurement data using appropriate tools, such as rulers marked with halves and fourths of an inch, and show the data by making a line plot where the horizontal scale is marked off in appropriate units—whole numbers, halves, or quarters. For example, students could make a line plot to show the length of a variety of fossils, then use that data, as well as other observational data, to make comparisons to modern-day organisms and to support their thinking. Questions such as the ones below might be used to guide students' analysis of data.

- ✓ Do any of the fossilized organisms resemble organisms that we see today? In what ways?
- ✓ Can you make any inferences about a fossilized organism's way of life based on size, body style, external features, or other similarities to modern-day organisms? (Where might it have lived? What might it have eaten? How might it have moved? Could it have been part of a group?)

Modifications	
Special Education: • Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community. • Provide students with multiple choices for how they can represent their understandings (e.g. multi-sensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling). • Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies). • Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences). • Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings. • Teacher models • Show additional number of samples/examples • Provide additional opportunities to practice • Use re-teaching and/or restating to address student's needs • Use small group table conferences to address needs • Develop target vocabulary • Scaffold comprehension when reading is necessary to fully understand science concept(s) • Use graphic organizers to develop key concepts/ideas • Teach key aspects of a topic and eliminate nonessential information.	**English Language Learners (ELLs):** • Model Thinking Aloud • Encourage Partner Talk • Repeat and Clarify • Provide a Sequence • Encourage self-selection of topics • Target vocabulary • Scaffold comprehension when reading is used to promote reader response • Scaffold content-literacy reading • Allow products to demonstrate student's learning • Provide on-going feedback

Students at Risk of School Failure:	**Gifted Students:**
● Build a relationship ● Allow flexible due dates ● Employ strategies from *"Classroom Instruction that Works"* ● Create the Opportunity to Learn strategies ● Build lessons around student interests	• Utilize flexible groups-group gifted students with other gifted students or higher-level learners • Encourage students to explore/research concepts in depth via independent studies or investigations (individual/group) • Differentiate product assignments. Employ differentiated curriculum to keep interest/motivation high • Encourage creative expression and thinking by allowing students to choose how to approach a problem or assignment (problem based learning) • Invite students to explore different points of view on a topic of study and compare the two • Provide multiple opportunities for students to "Own Their Learning" • Ask students higher-level questions that require students to look into causes, experiences, and facts to draw a conclusion to other areas of learning. (Webb's Depth of Knowledge- Level 4) • Create a room environment that encourages creativity and discovery through the use of interesting literature and reference materials. Supply reading materials on a wide variety of subjects and levels • Provide a learning-rich environment that includes a variety of resources, media, tasks, and methods of teaching

Prior Learning

Kindergarten Unit 4: Basic Needs of Living Things

- Living things need water, air, and resources from the land, and they live in places that have the things they need. Humans use natural resources for everything they do.
- Asking questions, making observations, and gathering information are helpful in thinking about problems. *(secondary)*

Grade 2 Unit 1: Relationships in Habitats

- Plants depend on water and light to grow.
    - Plants depend on animals for pollination or to move their seeds around.

Future Learning

Grade 4 Unit 2: Earth Processes

- A variety of hazards result from natural processes (e.g., earthquakes, tsunamis, volcanic eruptions). Humans cannot eliminate the hazards but can take steps to reduce their impacts.

Grade 4 Unit 7: Using Engineering Design with Force and Motion Systems

- Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. *(secondary)*

Grade 6 Unit 2: Matter and Energy in Organisms and Ecosystems

- Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors.
- In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction.
- Growth of organisms and population increases are limited by access to resources.
- Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species

involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared.

Grade 6 Unit 3: Interdependent Relationships in Ecosystems

- Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations.
- Biodiversity describes the variety of species found in Earth's terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health.

Grade 7 Unit 8: Earth Systems

- The geologic time scale interpreted from rock strata provides a way to organize Earth's history. Analyses of rock strata and the fossil record provide only relative dates, not an absolute scale.
- Maps of ancient land and water patterns, based on investigations of rocks and fossils, make clear how Earth's plates have moved great distances, collided, and spread apart.

Grade 8 Unit 1: Evidence of Common Ancestry and Diversity

- The collection of fossils and their placement in chronological order (e.g., through the location of the sedimentary layers in which they are found or through radioactive dating) is known as the fossil record. It documents the existence, diversity, extinction, and change of many life forms throughout the history of life on Earth.
- Anatomical similarities and differences between various organisms living today and between them and organisms in the fossil record, enable the reconstruction of evolutionary history and the inference of lines of evolutionary descent.
- Comparison of the embryological development of different species also reveals similarities that show relationships not evident in the fully-formed anatomy.

Grade 8 Unit 2: Selection and Adaptation

- Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes.

Grade 8 Unit 4: Human Impacts

- Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things.

Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.

Appendix A: NGSS and Foundations for the Module		
Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago. *[Clarification Statement: Examples of data could include type, size, and distributions of fossil organisms. Examples of fossils and environments could include marine fossils found on dry land, tropical plant fossils found in Arctic areas, and fossils of extinct organisms.]* [Assessment Boundary: Assessment does not include identification of specific fossils or present plants and animals. Assessment is limited to major fossil types and relative ages.*]* **(3-LS4-1)**		
Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.* *[Clarification Statement: Examples of environmental changes could include changes in land characteristics, water distribution, temperature, food, and other organisms.]* [Assessment Boundary: Assessment is limited to a single environmental change. Assessment does not include the greenhouse effect or climate change.*]* **(3-LS4-4)**		
Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost. (3-5-ETS1-1)		
The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:		
Science and Engineering Practices	**Disciplinary Core Ideas**	**Crosscutting Concepts**
Analyzing and Interpreting Data • Analyze and interpret data to make sense of phenomena using logical reasoning. (3-LS4-1) **Engaging in Argument from Evidence** • Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem. (3-LS4-4) **Asking Questions and Defining Problems** • Define a simple design problem that can be solved through the development of an	**LS4.A: Evidence of Common Ancestry and Diversity** • Some kinds of plants and animals that once lived on Earth are no longer found anywhere. (3-LS4-1) • Fossils provide evidence about the types of organisms that lived long ago and also about the nature of their environments. (3-LS4-1) **LS4.D: Biodiversity and Humans** • Populations live in a variety of habitats, and change in those habitats affects the organisms living there. (3-LS4-4)	**Scale, Proportion, and Quantity** • Observable phenomena exist from very short to very long time periods. (3-LS4-1) **Systems and System Models** • A system can be described in terms of its components and their interactions. (3-LS4-4) - ***Connections to Engineering, Technology, and Applications of Science***

object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost. (3-5-ETS1-1)	**LS2.C: Ecosystem Dynamics, Functioning, and Resilience** • When the environment changes in ways that affect a place's physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die.*(secondary to 3-LS4-4)* **ETS1.A: Defining and Delimiting Engineering Problems** • Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (3-5-ETS1-1)	**Interdependence of Engineering, Technology, and Science on Society and the Natural World** • Knowledge of relevant scientific concepts and research findings is important in engineering. (3-LS4-4) **Influence of Science, Engineering, and Technology on Society and the Natural World** • People's needs and wants change over time, as do their demands for new and improved technologies. (3-5-ETS1-1) ***Connections to Nature of Science*** **Scientific Knowledge Assumes an Order and Consistency in Natural Systems** • Science assumes consistent patterns in natural systems. (3-LS4-1)

English Language Arts	Mathematics
Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers. (3-LS4-4) **RI.3.1** Determine the main idea of a text; recount the key details and explain how they support the main idea. (3-LS4-1),(3-LS4-4) **RI.3.2** Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect. (3-LS4-1),(3-LS4-4) **RI.3.3** Write opinion pieces on topics or texts, supporting a point of view with reasons. (3-LS4-1),(3-LS4-4) **W.3.1** Write informative/explanatory texts to examine a topic and convey ideas and information clearly. (3-LS4-1),(3-LS4-4) **W.3.2** Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories. (3-LS4-1) **W.3.8** Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic. (3-5-ETS1-1) **W.5.7** Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources. (3-5-ETS1-1) **W.5.8** Draw evidence from literary or informational texts to support analysis, reflection, and research. (3-5-ETS1-1) **W.5.9** Report on a topic or text, tell a story, or recount an experience with appropriate facts and relevant, descriptive details, speaking clearly at an understandable pace. (3-LS4-4) **SL.3.4**	Reason abstractly and quantitatively. (3-LS4-1),(3-LS4-4), (3-5-ETS1-1) **MP.2** Model with mathematics. (3-LS4-1),(3-LS4-4), (3-5-ETS1-1) **MP.4** Use appropriate tools strategically. (3-LS4-1), (3-5-ETS1-1) **MP.5** Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using information presented in scaled bar graphs. (3-LS4-2),(3-LS4-3) **3.MD.B.3** Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units—whole numbers, halves, or quarters. (3-LS4-1) **3.MD.B.4** Operations and Algebraic Thinking (3-ETS1-1) **3-5.OA**

Module #4a and 4b "Organisms & the Environment" *(CBBS "Life in Ecosystems Kit")*
Core Lesson #1 *"Observing Life in an Ecosystem"*

Essential Question(s):

- Why do some animals live together in groups?
- What patterns exist as living things grow and develop?

Objectives	NJSLS Standard(s)	Segment	Time	Instructional Plan/Materials
SWBAT: • Distinguish between the different ecosystems and identify plants and animals that exist in each • Observe and investigate group behavior in animals while determining the benefits of this behavior • Compare plant and animal life cycles to determine that all living things are created/born, grow/develop, reproduce, and die	3.LS1.1 3.LS2.1 LS1.B LS2.D L.3.4A L.3.4D RI.3.1-4 RI.3.7 SL.3.1-4 W.3.1 3.MD.A.1	*Introduction/ Anticipatory Set*	- two 30 minute class periods	**Part A:** "Pre-Unit Assessment: Ecosystem Diversity" TG pg. 5 • Ecosystems class charts (what students already know about deserts, grasslands, forests, Arctic tundra, oceans, and rainforests) • Follow Activity Instructions for Part A (TG pgs. 5-7) • Read pgs. 2-3 "Life in Ecosystems" Literacy Series Reader (See Appendix E in TG) • Introduce butterfly larva and discuss same • Distribute seed materials and trays to small groups • Student Activity Sheet 1A "Growing Wisconsin Fast Plants"
		Activity	- one 30 minute class period	**Part B:** "Strength in Numbers" TG pg.7 • Follow Activity Instructions for Part B (TG pgs. 7-9) • Record observations of plants and

				larva in science notebooks • Distribute the "Group Animals Photo Card Set" – one per group • Science Notebook Opportunity TG pg. 9 "If you were an animal in the wild, would you rather be part of a group community or would you rather be a solitary animal who lives by itself?"
		Evaluation/ Assessment	- one 30 minute class period	**Part C:** "Growing Up" TG pg. 9 • Follow Activity Instructions for Part C (TG pgs. 9-11) • Record observations of plants and larva in notebooks • Student Activity Sheet 1B "Life Cycles" • Student Activity Sheet 1C "Lab Booklet" • Notebook Prompt TG pg. 12 "After a living thing is created, explain the stages it will go through in it life cycle" • Possible "Extensions" TG pg. 12
Key Vocabulary: • Arctic tundra • Desert • Ecosystem • Environment • Forest • Germinate				

- Grassland
- Habitat
- Life cycle
- Ocean
- Organism
- Rainforest
- Reproduce
- Survive

Module #4a and 4b "Organisms & the Environment" *(CBBS "Life in Ecosystems Kit")*
Core Lesson #2 *"Inheritance and Variation of Traits"*

Essential Question(s):

- What characteristics do living things get from their parents?
- Why don't all living things look exactly the same?

Objectives	NJSLS Standard(s)	Segment	Time	Instructional Plan/Materials
SWBAT: • Distinguish between inherited traits and acquired traits in organisms. • Investigate various traits that an offspring inherits from its parents. • Analyze variations of traits that occur among members of the same species.	3.LS.1 LS3.A LS3.B RI.3.1-4 RI.3.7 SL.3.1 SL.3.4 W.3.2.A W.3.2.B 3.MD.B.3 3.NF.A3.D	*Introduction/ Anticipatory Set*	- one 30 minute class period	**Part A:** "Unique Individuals" TG pg. 25 • Follow Activity Instructions for Part A (TG pgs. 25-27) • Allow students time to check plants and larva. Record observations in Lab Booklets • Distribute Student Activity Sheet 2A: "Unique Individuals" • Distribute a copy of Teacher Sheet 2: "Common Inherited Traits" TG pg. 31 to each group • Review the differences between inherited and acquired traits
		Activity	- one 30 minute class period	**Part B:** "Variations in a Species" TG pg. 27 • Follow Activity Instructions for Part B (TG pgs. 27-29) • Allow students time to check plants and larva and record same in Lab Booklets • Distribute one card from the Variations Photo Card Set and

				Student Activity Sheet 2B: "Variations in a Species" • Science Notebook Opportunity TG pg. 29 • Notebook Prompt TG pg. 30 "Imagine a puppy was adopted by a new family. What are some traits that the puppy inherited from its parents? What are some traits that is may acquire from its new environment as it grows up?" • Possible "Extensions" TG pg. 30 • Read pgs. 12-13 "Life in Ecosystems" Literacy Series Reader (See Appendix E in TG)
Key Vocabulary: • Acquired trait • Inherited trait • Offspring • Organism • Reproduce • Species • Trait • Variation				

Module #4a and 4b "Organisms & the Environment" *(CBBS "Life in Ecosystems Kit")*
Core Lesson #3 *"Observing Life in an Ecosystem"*

Essential Question(s):

- How do living things survive in their environment?

Objectives	NJSLS Standard(s)	Segment	Time	Instructional Plan/Materials
SWBAT: • Distinguish between behavioral and physical adaptations • Investigate the relationships between animal adaptations and food animals eat • Simulate predator-prey relationships and the benefits of camouflage • Distinguish between variations in an adaptation that can help an organism survive well, less well, or not at all in its environment	3.LS3.1 3.LS4.2 3.LS4.3 LS3.B LS4.B LS4.C L.3.4 RI.3.1-4 RI.3.7 SL3.1-3 SL.3.6 W.3.2 3.MD.B.3 3.OAA.1	*Introduction/ Anticipatory Set*	- one 30 minute class period	**Part A:** "Adaptations" TG pg. 40 • Follow Activity Instructions for Part A (TG pgs. 40-41) • Allow students time to observe plants and butterfly larva. Direct each student to record two traits that the larva/butterflies and Fast Plants have inherited from their parents. Orally review and share same • Read pgs. 4-5 of "Life in Ecosystems" Literacy Series Reader and record student ideas on a "Behavioral" T-chart TG pg.40 • Read aloud pgs. 6-7 of "Life in the Ecosystems" literacy series reader and record student ideas on a "Physical" T-chart TG pg. 41 • Student Activity Sheet 3A "Adaptations"
		Activity	- one 30 minute class	**Part B:** "Unique Beaks" TG pg.41 • Follow Activity Instructions for Part B (TG pgs. 41-44)

			period	• Record observations of plants and butterfly larva in Lab Booklets • Distribute Bird Cards (from Teacher Sheet 3A – one per group • Student Activity Sheet 3B "Unique Beaks" • Direct students to record their conclusions by responding to the prompt in Part D of Student Activity Sheet 3B • Science Notebook Opportunity (TG pg. 44)
		Evaluation/ Assessment	- one 30 minute class period	**Part C:** "Now You See me, Now You Don't" TG pg. 45 • Follow Activity Instructions for Part C (TG pgs. 45-47) • Allow students time to check on their plants and butterfly larva and record observations in Lab Booklets. On page 6 of the Lab Booklet, have students record some adaptations that allow the butterflies and the Fast Plants to better survive in their environments • Follow directions on TG pgs. 45-47 • Student Activity Sheet 3C "Now You See Me, Now You Don't"

				• Notebook Prompt TG pg. 49 "Explain how variations, or differences in polar bears' fur can help individuals survive well, less well, or not at all in the Arctic tundra • Possible "Extensions" TG pg. 48 • Read pgs. 8-11 "Life in Ecosystems" Literacy Series Reader (See Appendix E in TG)
Key Vocabulary: • Adaptation • Behavioral adaptation • Camouflage • Environment • Inherit • Organism • Physical adaptation • Predator • Prey • Variation				

Module #4a and 4b "Organisms & the Environment" *(CBBS "Life in Ecosystems Kit")*
Core Lesson #4 *"Environmental Influences"*

Essential Question(s):

- How does the environment influence living things?

Objectives	NJSLS Standard(s)	Segment	Time	Instructional Plan/Materials
SWBAT: • Infer and explain how traits can be influenced by the environment • Simulate how environmental changes can affect the development of traits • Argue and defend the idea that some organisms survive well, less well, or not at all in their environment • Predict the results of a problem caused by environmental changes and how these changes may affect the plants and animals that live there	3.LS3.2 3.LS4.3 3.LS4.4 LS2.C LS3.A LS3.B LS4.C LS4.D L.3.4 RI.3.1-4 RI.3.7 SL.3.1-3 W.3.1 3.MD.B.3	*Introduction/ Anticipatory Set*	- one 30 minute class period	**Part A:** "Environmental Influences" TG pg. 59 • Follow Activity Instructions for Part A (TG pgs. 59-62) • Allow students time to observe plants and butterfly larva recording findings in their Lab Booklets • Distribute Student Activity Sheet 4A: "Changes in the Environment" • Science Notebook Opportunity TG pg. 62 "Imagine you grew up in another country. How do you think you may have developed differently in this environment?"
		Activity	- one 30 minute class period	**Part B:** "Survival of the Fittest" TG pg. 62 • Follow Activity Instructions for Part B TG pgs. 62-63

				• Allow students time to observe plants and butterflies and record life cycle stages in their Lab Booklets • On page 7 of the Lab Booklets, direct students to describe at least one way the environment can affect how the butterflies and Fast Plants grow TG pg. 62 • Distribute "Coral Reef" sheet and have students identify eight crabs and their variations • Distribute Student Activity Sheet 4B "Survival of the Fittest" • Notebook Prompt: "A forest fire destroys a very large habitat out in Yellowstone National Park. How might the plants and animals who live the affected area respond to this change?" • Possible "Extensions" TG pg. 64 • Read pgs. 10-13 "Life in Ecosystems" Literacy Series Reader (See Appendix E in TG)
Key Vocabulary: All vocabulary from previous lessons				

Module #4a and 4b "Organisms & the Environment" *(CBBS "Life in Ecosystems Kit")*
Core Lesson #5 *"Learning from Fossils"*

Essential Question(s):

- What do fossils tell us about the past?

Objectives	NJSLS Standard(s)	Segment	Time	Instructional Plan/Materials
SWBAT: • Analyze fossil structures and infer which present-day organisms could have descended from them • Analyze and interpret data to draw the conclusion that the organisms and the environments they lived in change over time • Design and construct a new animal species that ties in concepts that have been learned throughout the unit	3.LS4.1 3.LS4.4 LS4.A LS4.D L.3.4 RI.3.1-4 RI.3.7 SL.3.1-3 SL.3.6 W.3.1 3.OA.B.6	*Introduction/ Anticipatory Set*	- one 30 minute class period	**Part A:** "Fossilized Evidence" TG pg. 72 • Follow Activity Instructions for Part A (TG pgs. 72-73) • Allow students time to observe their plants and butterflies recording life cycle changes in their Lab Booklets • Student Activity Sheet 5A "Adaptations" Student Activity Sheet 3A "Fossilized Evidence" • Student Activity Sheet 5B "Present-Day Organisms" • Orally review how fossils can be used as evidence to help explain the past and make connections to the present day
		Activity	- one 30 minute class	**Part B:** "Evidence from the Past" TG pg. 73 • Follow Activity Instructions for

			period	Part B (TG pgs. 73-75) • Allow students time to observe their plants and butterflies recording life cycle changes in their Lab Booklets • Distribute and read Literacy and Science 5: Evidence from the past – one per student • Review the Seven Continents and distribute Student Activity Sheet 5C "Fossil Map" – one per student • Science Notebook Opportunity TG pg. 75 "Take the Fossil Quiz on panel 6 of Literacy and Science5: *Evidence from the Past* and record answers in complete sentences in science notebooks
		Evaluation/ Assessment	- one to two 30 minute class periods	**Part C:** Project-Based Assessment TG pg. 75 • Follow Activity Instructions for Part C (TG pgs. 74-75) • Distribute Student Activity Sheet 5C "New Discovery" • Have students present their organisms to the class • Notebook Prompt TG pg.78 "Based on what you learned in this lesson, provide a logical argument to explain why some

				animals during the dinosaur's time were able to survive while the dinosaurs could not." • Possible "Extensions" TG pg. 77 • Read pgs. 12-13, 15 "Life in Ecosystems" Literacy Series Reader (See Appendix E in TG)
Key Vocabulary: • Adaptation • Ancestor • Ecosystem • Extinct • Fossil • Inherited trait • Life cycle • Paleontologist • Species				