Washington Township School District

The mission of the Washington Township Public Schools *is to provide a safe, positive, and progressive educational environment that provides opportunity for all students to attain the knowledge and skills specified in the NJ Learning Standards at all grade levels, so as to ensure their full participation in an ever-changing world as responsible, self-directed and civic-minded citizens.*

Course Title:	**Science**
Grade Level(s):	**8th**

Duration:	*Full Year:*	**X**	*Semester:*		*Marking Period:*	
Course Description:	**The Washington Township School District eighth grade science curriculum uses an integrated approach to general science that focuses with units on physical, life, and earth science. By using this approach, teachers are able to meets the needs of all students while aligning with the New Jersey Model Curriculum and the Next Generation Science Standards. Hands on activities are stressed and include student discovery, laboratory experiments, problem solving, model building, cooperative learning, computer usage, classroom discussion, teacher demonstrations, and writing opportunities for research and self-expression. Interdisciplinary subject areas are incorporated whenever possible. Students are introduced to the use of scientific tools and methods used for investigations.**					
Grading Procedures:	Tests/ Labs/Projects - 50% Quizzes – 35% Homework/Class work – 15%					
Primary Resources:	Next Generation Science Standards NGSS, New Jersey Student Learning Standards NJSLS, New Jersey Model Curriculum Grade Pearson Realize 21st Century Learner Framework					

Washington Township Principles for Effective Teaching and Learning

- Implementing a standards-based curriculum
- Facilitating a learner-centered environment
- Using academic target language and providing comprehensible instruction
- Adapting and using age-appropriate authentic materials
- Providing performance-based assessment experiences
- Infusing 21st century skills for College and Career Readiness in a global society

Designed by:	Joann Braker and Susan Flaherty

Under the Direction of:	Dr. Patricia Hughes

Written: _____

Revised: _____

BOE Approval: _____

Unit Title: Science Skills

Unit Description: Students will be reinforce skills required to be successful in the science classroom. In the first part, students will review the scientific method with emphasis on data collection, analysis, and drawing and supporting conclusions. In the second part students will work on scientific measurement and graphing using mathematical skills.

Unit Duration: about six weeks

Desired Results

Standard(s):

Part 1 - Using Scientific Inquiry – MS-ETS1-1, MS-ESS3-5

Part 2 - Mathematics and Models in Science – MS-ETS1-1

Indicators:

Part 1 - ETS1.B Developing Possible Solutions, ETS1.C Optimizing the Design Solution, ESS3.C Human Impacts on Earth Systems, ESS3.D Global Climate Change

Part 2 - ETS1.C Optimizing the Design Solution

Understandings:

Students will…

Part one

Lesson one

- Gather and synthesize information to identify skilled scientists use to learn about the world

Lesson two

- Gather and synthesize information to explain what scientific investigations involve
- Compare and contrast scientific thinking and nonscientific thanking
- Apply scientific principles to explain it characterizes science and its methods

Lesson three

- Apply scientific principles to explain what scientific inquiry is and how involves posing questions and developing hypotheses
- Design and construct an experiment that uses sound scientific principles
- Gather and synthesize information to compare how scientific explanation that developed an experimental sciences and historical sciences

Lesson four

- Construct a scientific explanation based on evidence for what scientific illiteracy is and why it is important
- Develop and use models to explain how to analyze scientific claims using scientific reasoning
- Gather and synthesize information to describe how to conduct background research on a scientific question and evaluate sources of information

Part two

Lesson one

Essential Questions:

Part 1 – Using Scientific Inquiry

- How does science and society affect each other?

Part 2 - Mathematics and Models in Science

- How do scientists use and measurement and mathematics?

- Apply scientific principles to explain why scientists use a standard measurement system
- Use mathematical representations to identify the SI units of measure for length, mass, volume, density, time, and temperature

Lesson two

- Gather and synthesize information to describe what math skills scientists use and collecting data in making measurements
- Apply scientific principles to identify the math tools scientists used to analyze data

Lesson three

- Use graphical displays to explain what kinds of data goal line grants can display

Lesson four

- Gather and synthesize information to explain how models are used in science
- Apply scientific principles to describe different types of systems and identify characteristics that all systems share
- Apply scientific principles to examine models of natural systems and compare the model to the system itself

Lesson five

- Apply scientific principles to explain why preparation is important in carrying out investigations in the lab and in the field
- Gather and synthesize information to describe what to do if an accident occurs

Assessment Evidence

Performance Tasks:

- Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.
- Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system
- Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.
- Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer
- Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.
- Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.
- Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.
- Integrate qualitative scientific and technical information to support the claim that digitized signals (sent as

Other Evidence:

Lesson quizzes, Chapter Tests, Labs

Performance Assessments
Part 1 Lab: Become a Learning Detective
Part 2 Lab: Selecting Models

wave pulses) are a more reliable way to encode and transmit information than analog signals.	

Benchmarks: To be determined

Learning Plan

Learning Activities:

Part 1: Using Scientific Inquiry

- **Introduce the Big Q** and students will answer question
- Watch Untamed Science video “DNA Crop Dusters"
- Preview vocabulary
- Complete Scenario Investigation **Casting a Vote That Makes Sense**

Lesson 1: How Scientists Work

- Introduce Vocabulary
- Read **My Planet Diary** as a class
- Students will do the **Inquiry Warm-Up** activity and complete the **After the Inquiry Warm-Up** Worksheet
- Review the terms qualitative and quantitative observation
- Help students understand that scientists use specific skills when conducting an investigation into the natural world such as observing, classifying, making models, inferring, predicting, and analyzing
- Discuss how scientists use the skills as they form and test their ideas through scientific investigation
- Discuss inferring and predicting and help students distinguish between the two
- **Quick Lab:** Scientific Skills
- Practice calculations involving piclitaxel in the **Do The Math** activity
- **Support the Big Q** to emphasize how science and society affect each other
- Review Key Concepts and administer lesson quiz

Lesson 2: The Characteristics of Scientific Knowledge

- Introduce Vocabulary
- Read **My Planet Diary** as a class
- Students will do the **Inquiry Warm-Up** activity and complete the **After the Inquiry Warm-Up** Worksheet
- Explain that scientific investigations involve collecting evidence and using that evidence to make inferences and draw conclusions
- **Support the Big Q** by using animal research to discuss how science affect society, and vice versa
- Clearly differentiate science and pseudoscience
- Point out that science and its methods are characterized by an ordered approach to learning about the world
- Explain that this approach relies on objective analysis of data
- **Quick Labs:** Activities of science, Science and Its Method, and/or Science Thinking
- **Apply it Activity**
- Review Key Concepts and administer lesson quiz

Lesson 3: Designing an Experiment

- Introduce Vocabulary
- Read **My Planet Diary** as a class
- Students will do the **Inquiry Warm-Up** activity and complete the **After the Inquiry Warm-Up** Worksheet
- Explain the scientific inquiry process
- Discuss how observations lead to a strong hypothesis
- Explain the role of hypotheses and experimental design
- Discuss possible sources of error and experimental design
- Review graphing, reading graphs, and using graphs to make predictions in the **Do the Math** activity
- **Directed Inquiry:** Becoming a Learning Detective
- **Apply it Activity**: analyze experimental results and identify experimental bias

- **Support the Big Q** to discuss a scientific results affect society
- Discuss scientific explanations
- **Quick Labs:** How Can You Explain It? And/or Starts With a Question
- Review Key Concepts and administer lesson quiz

Lesson 4: Scientific Literacy

- Introduce Vocabulary
- Read **My Planet Diary** as a class
- Students will do the **Inquiry Warm-Up** activity and complete the **After the Inquiry Warm-Up** Worksheet
- Explain that scientific literacy is knowing where to find scientific information how to evaluate and apply it to everyday life
- Discuss the difference between evidence and opinions
- Explain that when students encounter a scientific claim, they can use scientific reasoning to analyze and make sense of it
- **Apply it activity**
- Explain that to make decisions and design experiments effectively, they need to do research to grab gather relevant, reliable background information
- **Explore the Big Q**: use figure four to discuss the interaction of science and society using the plastic bottle as an example
- **Answer the Big Q**: discuss how science and society affect each other
- **Quick Labs:** Analyzing Claims, Scientific Literacy Survey, and/or Source of Information
- Review Key Concepts and administer lesson quiz

Part 2: Mathematics and Models in Science

Introduce the Big Q and students will answer question

- Watch Untamed Science video “Meters and Liters and Grams, Oh My!"
- Preview vocabulary
- Complete STEM Activity **Flipping the Switch**

Lesson 1: Scientific Measurement

- Introduce Vocabulary
- Read **My Planet Diary** as a class
- Students will do the **Inquiry Warm-Up** activity and complete the **After the Inquiry Warm-Up** Worksheet
- Review the prefixes used in SI and how each prefix relates to the number 10
- Help students understand the advantages of a standard system of measurement
- Explain a standard measurement system helps scientists compare data and share results
- **Do the math** activity to emphasize how the SI measurements increase or decrease based on powers of 10
- Introduced SI unit for length
- Define mass in weight and identify the SI unit for each
- Discuss the difference between mass and weight
- The fine volume and identify the SI units used to measure volume
- Discuss how to measure the volume of your regular solids
- Introducing defined density and identify the SI units used to measure density
- **Apply it Activity**
- Introduce the SI unit for time and temperature
- **Quick Labs**: A Unit of SI and/or Measuring With SI
- Review Key Concepts and administer lesson quiz

Lesson 2: Mathematics and Scientific Thinking

- Introduce Vocabulary
- Read **My Planet Diary** as a class
- Students will do the **Inquiry Warm-Up** activity and complete the **After the Inquiry Warm-Up** Worksheet
- Discuss when using estimates are useful
- Use figure 1 to give students practice in estimating
- Use figure 2 so students can gain practice distinguishing between accuracy and precision
- Make an analogy for accuracy and precision by comparing a drill team and a marching band
- Discuss how precision is influenced by the equipment used to measure
- Explain significant figures using figure 3
- Explain how math tools allow you to analyze data see you can draw conclusions
- Use figure 4 to teach mean, medium, mode, and range
- Discuss the importance of these math tools, anomalous data, and percent error

- **Explore the Big Q** by evaluating the precision of density calculations
- **Quick Labs**: Is It Accurate and/or Math Tools in Science
- Review key concepts and administer lesson quiz

Lesson 3: Using Graphs in Science

- Introduce Vocabulary
- Read **My Planet Diary** as a class
- Students will do the **Inquiry Warm-Up** activity and complete the **After the Inquiry Warm-Up** Worksheet
- Explain the grass illustrate different types of data
- Discuss the difference between linear and non-linear graphs
- Explain how outliers on a graph indicate anomalous data
- **Apply it Activity**: practice plotting a non-linear graphs and using the graphs to recognize anomalous data
- **Support the Big Q** to review the ways in which graphs are in mathematical tool for scientists
- **Quick Lab:** Recognizing Trends (using Vernier Probes)
- Review key concepts and administer lesson quiz

Lesson 4: Models and Systems

- Introduce Vocabulary
- Read **My Planet Diary** as a class
- Students will do the **Inquiry Warm-Up** activity and complete the **After the Inquiry Warm-Up** Worksheet
- Explain that scientists use models to observe things they cannot see directly
- Defined system and point out the three components (input, process, and output) that every system has
- Explain how models are helpful and understanding systems
- **Apply it Activity**
- **Support the Big Q** by discussing how measurement and mathematics can be used to make models
- Discuss how assumptions are made and checked in science as in daily life
- **Directed Inquiry**: Selecting Models
- **Quick Labs**: Characteristics of Systems and/or Working With Models
- Review Key Concepts and administer lesson quiz

Lesson 5: Safety in the Science Laboratory

- Introduce Vocabulary
- Read **My Planet Diary** as a class
- Students will do the **Inquiry Warm-Up** activity and complete the **After the Inquiry Warm-Up** Worksheet
- Discuss two things students should do before beginning any scientific investigation
- Observe the photo of students working in the field
- Use figure 1 to lead a thorough discussion of laboratory safety procedures
- **Support the Big Q** by asking students why scientists follow safety precautions
- Use figure 2 to discuss proper care of animals
- Explain proper procedures to follow in case of an accident
- Use figure 3 to discuss safety equipment
- **Quick Labs:** Be Prepared to Be Safe in the Field and/or How Would You Respond to These Emergencies?
- Review Key Concepts and administer lesson quiz

Resources:

Interactive Science Program

Vernier Lab Pro™Equipment (Thermometers)

Unit Learning Goal and Scale *(Level 2.0 reflects a minimal level of proficiency)*	
Standard(s): MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.	
4.0	**Students will be able to:** • In addition to score 3.0 performance, the student demonstrates in-depth inferences and applications that go beyond what was taught.
3.0	**Students will be able to:** • Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
2.0	**Students will be able to:** • Recognize and recall specific vocabulary (with 80% success): science, observing, quantitative observation, qualitative observation, classifying, inferring, predicting, analyzing, skepticism, data, empirical evidence, objective reasoning, subjective reasoning, pseudoscience, scientific inquiry, hypothesis, independent variable, dependent variable, controlled experiment, bias, repeated trial, replication, scientific explanation, scientific literacy, evidence, opinion, metric system, International System of Units (SI), mass, weight, volume, meniscus, density, estimate, accuracy, precision, significant figures, mean, median, mode, range, anomalous data, percent error, graph, linear graph, nonlinear graph, outlier, model, system, input, process, output, feedback, field
1.0	**With help, partial success at level 2.0 content and level 3.0 content:**
0.0	**Even with help, no success**

Standard(s): MS – ESS 3-5: Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.	
4.0	**Students will be able to:** • In addition to score 3.0 performance, the student demonstrates in-depth inferences and applications that go beyond what was taught.
3.0	**Students will be able to:** • Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.
2.0	**Students will be able to:** • Recognize and recall specific vocabulary (with 80% success): reflection, refraction, diffraction, interference, constructive interference, destructive interference, standing wave, node, antinode, resonance, density, music, fundamental tone, overtone, ear canal, eardrum, cochlea, echolocation, ultrasound, sonar, sonogram, transparent, translucent, opaque, primary color, secondary color, complementary color, pigment, ray, regular reflection, image, diffuse reflection, plane mirror, virtual image, concave mirror, optical axis, focal point, real image, convex mirror, index of refraction, mirage, lens, concave lens, convex lens, cornea, pupil, iris, retina, rods, cones, optic nerve, nearsighted, farsighted, camera, telescope, refracting telescope, objective, eyepiece, reflecting telescope, microscope • Describe the reflection, absorption, and transmission of waves.
1.0	**With help, partial success at level 2.0 content and level 3.0 content:**
0.0	**Even with help, no success**

Unit Modifications for Special Population Students	
Advanced Learners	Enrichment Worksheets and Scenario Investigations

Struggling Learners	Use L1 Differentiated Instruction Activities
English Language Learners	Use ELL Support Activities from lesson as needed. http://www.state.nj.us/education/modelcurriculum/ela/ELLSupport.pdf
Special Needs Learners	Follow IEP modifications and work with special education teacher to make modifications and use L1 Differentiated Instruction Activities. http://www.nj.gov/education/udl/

Interdisciplinary Connections

Indicators:

ELA:

- Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).
- Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
- Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.

MATH:

- Use mathematical representations to identify the SI units of measure for length, mass, volume, density, time, and temperature
- Write, interpret, and explain statements of order for rational numbers in real-world contexts
- Summarize numerical data sets in relation to their context.
- Model with mathematics.

Integration of 21st Century Skills

Indicators:

To function in the 21st Century work place a variety of skills need to be developed and strengthened some of those would be:

• Developing and Using Models
• Planning and Carrying Out Investigations [supported in the science lab setting but useful in many aspects of life]
• Constructing Explanations and Designing Solutions [supporting explanations with research and experimentation]
• Engaging in Argument from Evidence
• Analyzing and Interpreting Data [collected during labs or proposed scenarios]
• Creativity and Innovation [brainstorm, collaborate and incorporate group ideas]
• Critical Thinking and Problem Solving [Follow the steps of the scientific method.]
• Communication and Collaboration [All types of communication are needed - oral, written and nonverbal communication in a variety of forms and contexts. It is also importanat to be able to listen effectively to decipher meaning, including knowledge, values, attitudes and intentions.]
• Flexibility and Adaptability [Adapt to varied roles, jobs and responsibilities, schedules and contexts.]
• Initiative and Self-Direction [Set goals, balance short-term and long-term goals. Utilize time and manage workload efficiently. Monitor, define, prioritize, and complete tasks without direct oversight. Demonstrate commitment to learning as a lifelong process. Reflect critically on past experiences to continue to improve.]
• Social and Cross-Cultural Skills [Know when it is appropriate to listen and when to speak. Conduct themselves in a respectable manner. Learn and respect cultural differences and work effectively with people from a range of social and cultural backgrounds. Respond open-mindedly to different ideas and values.]
• Productivity and Accountability Set and meet goals, even in the face of obstacles.]
• Leadership and Responsibility [Use interpersonal and problem-solving skills to influence and guide others toward a goal. Inspire others to reach their very best via example and selflessness. Demonstrate integrity and ethical behavior in using influence and power. Act responsibly with the interests of the larger community in mind.]

Unit Title: Life Science

Unit Description: Students will be introduced to theme concepts in biology. Students will learn about Darwin's theory of Natural Selection, how species change over time and evidence of that change.

Unit Duration: about three weeks

Desired Results

Standard(s):

Change over Time- MS-LS4-4

Indicators:

LS4.A Evidence of Common Ancestry and Diversity, LS4.B Natural Selection, LS4.C Adaptation

Understandings:

Students will…

Chapter 1

Lesson 1

- Apply scientific principles to describe how Darwin's observations helped him to develop his hypothesis.
- Use scientific principles to explain how natural selection leads to evolution.

Lesson 2

- Construct an explanation based on evidence that supports the theory of evolution.

Lesson 3

- Gather and synthesize information to explain how new species form.
- Apply scientific principles to identify the two patterns that describe the rate of evolution.

Essential Questions:

Chapter 1 – Change over Time

How do life forms change over time?

Assessment Evidence

Performance Tasks:

- Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on earth under the assumption that natural laws operate today as in the past.
- Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.
- Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy.
- Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.
- Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms.

Other Evidence:

Lesson quizzes, Chapter Tests, Labs

Performance Assessments:

Chapter 1 Lab: Nature at Work

• Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.	

Benchmarks: To be determined

Learning Plan

Learning Activities:

Chapter 1: Changes over time

- **Introduce the Big Q** and students will answer question
- Watch Untamed Science video "Why would a fish have red lips?'
- Preview vocabulary
- Complete Scenario Investigation **Worms Under Attack**

Lesson 1: Darwin's Theory

- Introduce vocabulary
- Read **My Planet Diary** as a class
- Students will do the **Inquiry Warm-Up** activity and complete the **After the Inquiry Warm-Up** Worksheet
- Lead a discussion: Darwin and his discoveries, comparison on the Galapagos Islands and conclusions, adaptations in the scientific sense, and what makes Darwin's study of turtles significant to science
- **Apply It Activity**
- Explain the four key points of Darwin's theory of natural selection
- Observe figure 5 to discuss natural selection
- **Directed inquiry lab:** Nature At Work
- **Answer the Big Q** by discussing how living things change over time
- Review Key Concepts and administer lesson quiz

Lesson 2: Evidence of Evolution

- Read **My Planet Diary** as a class
- Students will do the **Inquiry Warm-Up** activity and complete the **After the Inquiry Warm-Up** Worksheet
- Discuss question four classifying a tax bite traits
- Introduce Vocabulary
- Explain the four types of evidence that support evolution
- Lead a discussion about how fossils patterns of early development and similarities and body structures support the theory of evolution
- **Support the Big Q** by discussing why homologous structures evolve differently
- Lead a discussion about how scientists use DNA evidence
- **Apply It Activity**
- Species adaptation **Virtual Lab**
- Complete key concept summaries and review and quiz

Lesson 3: Rate of Change

- Read **My Planet Diary** as a class
- Students will do the **Inquiry Warm-Up** activity and complete the **After the Inquiry Warm-Up** Worksheet (TSW make a timeline of Earth's history)
- Introduce vocabulary
- Discuss isolation and variations on populations
- Lab: Impact of continental drift on new species
- The students will answer **Assess Your Understanding**
- Discuss gradualism and punctuated equilibrium
- **Support the Big Q**
- **Apply It Activity**
- **Quick Lab**: The students will observe evolution
- Review and administer chapter 1 assessment

Resources:

Interactive Science Program
Vernier Lab Pro™Equipment (Thermometers)

Unit Learning Goal and Scale
(Level 2.0 reflects a minimal level of proficiency)

Standard(s):
MS-LS4-4 Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.

4.0	**Students will be able to:** • In addition to score 3.0 performance, the student demonstrates in-depth inferences and applications that go beyond what was taught.
3.0	**Students will be able to:** • Use simple probability statements and proportional reasoning to defend the claim that genetic variation of traits in a population increase some individuals' probability of surviving and reproducing.
2.0	**Students will be able to:** • Recognize and recall specific vocabulary (with 80% success): species, fossil, adaptation, evolution, scientific theory, natural selection, variation, homologous structures, gradualism, punctuated equilibrium • Describe how genetic variation of traits in a population increase some individuals' probability of surviving and reproducing
1.0	**With help, partial success at level 2.0 content and level 3.0 content:**
0.0	**Even with help, no success**

Unit Modifications for Special Population Students

Advanced Learners	Enrichment Worksheets and Scenario Investigations
Struggling Learners	Use L1 Differentiated Instruction Activities
English Language Learners	Use ELL Support Activities from lesson as needed. http://www.state.nj.us/education/modelcurriculum/ela/ELLSupport.pdf
Special Needs Learners	Follow IEP modifications and work with special education teacher to make modifications and use L1 Differentiated Instruction Activities. http://www.nj.gov/education/udl/

Interdisciplinary Connections

Indicators:
ELA:

- Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions
- Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).
- Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.
- Draw evidence from informational texts to support analysis, reflection, and research.
- Engage effectively in a range of collaborative discussions (one-on-one, in groups, teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly.
- Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.

- Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.
- Gather relevant information from multiple print and digital sources; assess the credibility of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and providing basic bibliographic information for sources.

MATH:

- Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.
- Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.
- Summarize numerical data sets in relation to their context.
- Recognize and represent proportional relationships between quantities.

Integration of 21st Century Skills

Indicators:

To function in the 21st Century work place a variety of skills need to be developed and strengthened some of those would be:

• Developing and Using Models
• Planning and Carrying Out Investigations [supported in the science lab setting but useful in many aspects of life]
• Constructing Explanations and Designing Solutions [supporting explanations with research and experimentation]
• Engaging in Argument from Evidence
• Analyzing and Interpreting Data [collected during labs or proposed scenarios]
• Creativity and Innovation [brainstorm, collaborate and incorporate group ideas]
• Critical Thinking and Problem Solving [Follow the steps of the scientific method.]
• Communication and Collaboration [All types of communication are needed - oral, written and nonverbal communication in a variety of forms and contexts. It is also importanat to be able to listen effectively to decipher meaning, including knowledge, values, attitudes and intentions.]
• Information Literacy [Use information accurately and creatively for the issue or problem at hand.]
• Media Literacy [Apply a fundamental understanding of the ethical/legal issues surrounding the access and use of media.]
• ICT (Information, Communications and Technology) Literacy [Use technology as a tool to research, organize, evaluate and communicate information.]
• Flexibility and Adaptability [Adapt to varied roles, jobs and responsibilities, schedules and contexts.]
• Initiative and Self-Direction [Set goals, balance short-term and long-term goals. Utilize time and manage workload efficiently. Monitor, define, prioritize, and complete tasks without direct oversight. Demonstrate commitment to learning as a lifelong process. Reflect critically on past experiences to continue to improve.]
• Social and Cross-Cultural Skills [Know when it is appropriate to listen and when to speak. Conduct themselves in a respectable manner. Learn and respect cultural differences and work effectively with people from a range of social and cultural backgrounds. Respond open-mindedly to different ideas and values.]
• Productivity and Accountability Set and meet goals, even in the face of obstacles.]
• Leadership and Responsibility [Use interpersonal and problem-solving skills to influence and guide others toward a goal. Inspire others to reach their very best via example and selflessness. Demonstrate integrity and ethical behavior in using influence and power. Act responsibly with the interests of the larger community in mind.]

Unit Title: Earth Science

Unit Description: Students will be introduced to earth science concepts. The students will learn what causes climate, global climate regions, and changes in climate, and how human activity affects it. Students will learn about fossil fuels, renewable energy and conservation. The students will be introduced to environmental issues, natural resources, and population issues and propose and analyze potential solutions.

Unit Duration: about twelve weeks

Desired Results

Standard(s):

Climate and Climate Change – MS-ESS3-3; MS -ESS3-5; MS-ESS2-6

Energy Resources – MS -ESS3-3; MS-ESS3-4; MS-ESS3-1

Land, Air and Water Resources – MS-ESS3-3

Indicators:

ESS3.D Global Climate Change; ESS3.C Human Impact on Earth Systems; ESS2.D Weather and Climate

ESS3.C Human Impact on Earth Systems; ESS3.B Natural Hazards; ESS3.A Natural Resources

ESS3.C Human Impact on Earth Systems; ESS3.B Natural Hazards; ESS3.A Natural Resources

Understandings:

Students will…

Chapter 2

Lesson 1

- Apply scientific principles to identify factors that influence temperature.
- Construct a scientific explanation based on evidence to identify factors that influence precipitation.

Lesson 2

- Analyze and interpret data to identify factors used to define climates.
- Apply scientific principles to describe the six main climate regions.

Lesson 3

- Construct a scientific explanation based on evidence to explain the principle scientists follow in studying ancient climates.
- Apply scientific principles to identify natural factors that can cause climate change.

Lesson 4

- Apply scientific principles to explain how human activities are affecting the temperature of the atmosphere.

Chapter 3

Lesson 1

- Gather and synthesize information about the three major fossil fuels.
- Apply scientific principles to explain why fossil fuels are considered nonrenewable resources.

Lesson 2

- Gather and synthesize information about renewable sources of energy.
- Interpret information to explain how a nuclear power plant produces electricity.

Lesson 3

Essential Questions:

Chapter 2 – Climate and Climate Change
What factors affect Earth's climate?

Chapter 3 – Energy Resources
What are some of Earth's Energy Resources?

Chapter 4 – Land, Air and Water Resources
What can people do to use resources wisely?

- Gather and synthesize information to explain how human energy use has changed over time.
- Apply scientific ideas to describe ways to ensure that there will be enough energy for the future.

Chapter 4

Lesson 1

- Gather and synthesize information to identify the general categories of environmental issues.
- Explore how decision makers evaluate and balance opposing needs and concerns when establishing environmental policy.

Lesson 2

- Gather and synthesize information to explain what natural resources are and distinguish between renewable and nonrenewable resources.
- Apply scientific principles to explain why natural resources are important.

Lesson 3

- Gather and synthesize information to describe how people use land.
- Develop and use models to explain why soil management is important.

Lesson 4

- Use graphical displays to identify three methods of solid waste disposal.
- Apply scientific principles to identify ways people can help control the solid waste problem.
- Gather and synthesize information to describe how hazardous wastes can be disposed of.

Lesson 5

- Gather and synthesize information to identify the causes of indoor and outdoor air pollution.
- Develop and use models to explain the importance of the ozone layer and how it has been damaged.
- Construct a scientific explanation based on evidence to explain the key to reducing air pollution

Lesson 6

- Construct a scientific explanation based on evidence to explain why fresh water is a limited resource.
- Use graphical displays to identify the major sources of water pollution.
- Apply scientific principles to suggest possible solutions for reducing water pollution. U

Assessment Evidence

Performance Tasks:

- Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
- Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact earth's systems.

Other Evidence:

Lesson quizzes, Chapter Tests, Labs

Performance Assessments

Chapter 2 Lab: Sun Rays and Angles

Chapter 3 Lab: Design and Build a Solar Cooker

Chapter 4 Lab: Recycling Paper and Waste, Away!

• Apply scientific principles to design a method for monitoring and minimizing human impact on the environment. • Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century. • Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.	

Benchmarks: To be determined

Learning Plan

Learning Activities:

Chapter 2: Climate and Climate Change

- **Introduce the Big Q** and students will answer question
- Watch Untamed Science video "Searching for the Perfect Climate."
- Preview vocabulary
- Complete Scenario Investigation **What Causes our Climate?**

Lesson 1: What Causes Climate?

- Introduce vocabulary
- Read **My Planet Diary** as a class
- Students will do the **Inquiry Warm-Up** activity and complete the **After the Inquiry Warm-Up** Worksheet
- Explain the four factors that affect the temperature of a location
- **Support the Big Q** to illustrate how temperature is affected by that exceed
- Use figure two to identify and differentiate between three temperature is ounce
- Discuss how ocean is in a large lakes affect temperatures
- Sunny Rays and Angles **Directed Inquiry** (using Vernier Lab Pro)
- Identify the three main factors that affect precipitation
- **Apply It Activity**
- Review Key Concepts and administer lesson quiz

Lesson 2: Climate Regions

- Introduce Vocabulary
- Read **My Planet Diary** as a class
- Students will do the **Inquiry Warm-Up** activity and complete the **After the Inquiry Warm-Up** Worksheet
- Discuss which plants and animals live in various climates
- Identify the six main climate regions which are divided into 12 Climate types
- Describe the two types of tropical rainy climates and the two types of dry climates and discuss the characteristics of each
- **Support the Big Q** by analyzing and comparing the Climographs of Bangkok and Cairo
- Explain that temperate marine climates existing zones near the ocean's
- Locate and characterize temperate continental climates that are found only in the northern hemisphere
- Use figure two to identify the temperate marine climates in the United States
- Discuss the unit and continental and sub-arctic climates in the northern hemisphere
- Distinguish between the two polar climates
- Point out the unique characteristics of the Highlands
- Discuss the coldest climate regions
- **Apply It Activity**
- Review Key Concepts and administer lesson quiz

Lesson 3: Changes in Climate

- Introduce Vocabulary
- Read **My Planet Diary** as a class
- Students will do the **Inquiry Warm-Up** activity and complete the **After the Inquiry Warm-Up** Worksheet
- Climate Clues **Quick Lab**
- Explain that scientists base near inferences about ancient climates of the past on their knowledge of plant and animal life today
- Discuss how evidence of climate change is a scene in pollen records and tree rings
- Identify the fourth, an explanation for climate change
- Use figure three to examine how climate changes are related to continental movement long ago
- Teach about how earth's climate is impacted by the angle of earth's axis and the shape of the earth orbit
- **Support the Big Q** to illustrate how volcanic activity and solar activity could cause climate changes during students a lifetime
- Review Key Concepts and administer lesson quiz

Lesson 4: Human Activity and Climate Change

- Introduce Vocabulary
- Read **My Planet Diary** as a class
- Students will do the **Inquiry Warm-Up** activity and complete the **After the Inquiry Warm-Up** Worksheet (using Vernier Lab Pro)
- Compare a greenhouse to Earth's atmosphere
- Explain what is causing the level of greenhouse gases and global temperatures to rise
- Discuss the effects of global warming
- Use figure two to examine that changes in levels of carbon dioxide in the atmosphere over time
- Identify the locations in figure three that could be directly impacted by melting glaciers and rising sea levels
- Help students consider how human can limit global warming
- **Apply It Activity**
- **Virtual Lab:** Human Activities and Climate Change
- **Explore the Big Q** discuss of global warming impacts animals
- Identify the major factors that affect the earth's climate two answer the **Big Q**
- Review Key Concepts and administer lesson quiz

Chapter 3: Energy Resources

- **Introduce the Big Q** and students will answer question
- Watch Untamed Science video "Farming the Wind"
- Preview vocabulary
- Complete Scenario Investigation **Light Bulbs Can't Use Much Energy**

Lesson 1: Fossil Fuels

- Introduce vocabulary
- Read **My Planet Diary** as a class
- Students will do the **Inquiry Warm-Up** activity and complete the **After the Inquiry Warm-Up** Worksheet (both utilize Vernier Lab Pro)
- Lead a discussion: Discuss how fossil fuels are formed, mined, and used and the pros and cons
- **Apply It Activity**
- Lab: Observing Oil's Consistency
- Review Key Concepts and administer lesson quiz

Lesson 2: Renewable Source of Energy

- Read **My Planet Diary** as a class
- Students will do the **Inquiry Warm-Up** activity and complete the **After the Inquiry Warm-Up** Worksheet
- Introduce vocabulary
- Lead a discussion: Explain how solar energy is different in different areas, what are different sources of energy we use, how are biomass fuels made, and how energy is converted.
- **Apply It Activity**
- **Design and Build a Solar Cooker Directed** inquiry lab (using Vernier Lab Pro™)
- **Answer the Big Q** by discussing how some energy sources are limited some are not
- Review Key Concepts and administer lesson quiz

Lesson 3: Energy Use and Conservation

- Read **My Planet Diary** as a class

- Students will do the **Inquiry Warm-Up** activity and complete the **After The Inquiry Warm-Up** worksheet (using Vernier Lab Pro)
- Introduce vocabulary
- Discuss how energy usage has changed over time, compare efficiency and conservation, examine how to use fuels more efficient (globally and individually)
- **Apply It Activity**
- **Virtual Lab**: Biogas farming
- Review and administer chapter 3 assessment

Chapter 4: Land, Air, and Water Resources

- **Introduce the Big Q** and students will answer question
- Watch Untamed Science video “Manatee Survival"
- Preview vocabulary
- Complete STEM Activity **It’s All Water Under the Dam**

Lesson 1: Fossil Fuels

- Introduce vocabulary
- Read **My Planet Diary** as a class
- Students will do the **Inquiry Warm-Up** activity and complete the **After the Inquiry Warm-Up** Worksheet
- Explain the terms natural resource, pollution, point source and nonpoint source
- Use figure one and two to discuss the pros and cons of developing Antarctica and everyday natural resources such as land, water and fuel
- **Support the Big Q** to discuss the population growth may affect natural resources
- Explain how the different needs are balanced when legislators make environmental decisions
- **Apply it Activity**
- Review Key Concepts and administer lesson quiz

Lesson 2: Introduction to Natural Resources

- Read **My Planet Diary** as a class
- Students will do the **Inquiry Warm-Up** activity and complete the **After the Inquiry Warm-Up** Worksheet
- Introduce vocabulary
- I explained the terms of *renewable* and *nonrenewable resources* and how a resource can be both
- Explain that some resources are essential for human life
- **Support the Big Q** to help students distinguish between essential and nonessential natural resources
- Use figure two to discuss the use of resources in Sierra Leone, China, and Iceland
- **Apply it Activity**
- Discuss conservation and the three “R’s” strategy
- **Directed Lab: Recycling Paper**
- Review Key Concepts and administer lesson quiz

Lesson 3: Conserving Land and Soil

- Read **My Planet Diary** as a class
- Students will do the **Inquiry Warm-Up** activity and compete the **After The Inquiry Warm-Up** worksheet
- Introduce vocabulary
- Explain that agriculture, mining, and the developments are three ways that people use the land
- **Quick Lab**: Land Use
- Explain that causes of erosion, nutrient depletion, and desertification
- Discuss the structure of fertile soil using figure two and the benefits of terracing using figure three
- **Support the Big Q** by discussing the role that land reclamation playing in using our resources wisely
- Review the term *desertification*
- **Apply it Activity**
- **Quick Lab**: Modeling Soil Conservation
- Review Key Concepts and administer lesson quiz

Lesson 4: Waste Disposal and Recycling

- Read **My Planet Diary** as a class
- Students will do the **Inquiry Warm-Up** activity and compete the **After The Inquiry Warm-Up** worksheet
- Introduce vocabulary
- Explain that municipal booked solid waste is a waste produced by a city or town from homes, businesses, and schools
- **Apply it Activity**
- Use figure one to explain the terms *pollutants* and a *leachate*

- Discuss the advantages and disadvantages of incineration and a sanitary landfills for solid waste disposal
- **Support the Big Q** to help students understand the similarities and differences of reuse and recycling
- **Directed Inquiry:** Waste, Away!
- Explore the four major categories of recycling: metal, glass, paper, and plastic
- Help students categorized objects and products used in a typical day as "use once and dispose of" or "using many times"
- Explain that land fills are not the only method of hazardous waste disposal
- Discuss types of hazardous wastes, including radioactive material, flammable material, corrosive substances, and toxic substances
- **Quick Lab** Half Life
- Review Key Concepts and administer lesson quiz

Lesson 5: Air Pollution and Solutions

- Read **My Planet Diary** as a class
- Students will do the **Inquiry Warm-Up** activity and compete the **After The Inquiry Warm-Up** worksheet
- Introduce vocabulary
- Identify the major causes of outdoor and indoor and will air pollution
- Discuss specific examples of air pollution that students have encountered
- Discuss the causes of some of that and the causes and effects of acid rain
- **Apply it Activity**
- Remind students that air pollution exists indoors and outdoors
- **Quick Lab** How Acid is Your Rain (Using Vernier Lab Pro)
- Discuss the ozone layer
- Explain how the ozone cycle prevents harmful ultraviolet radiation for reaching the earth's surface
- Explain the importance of the ozone layer and how it has been damaged
- Use figure six to discuss what scientific inquiry has revealed that the ozone hole caused by chlorofluorocarbons
- Discuss how to reduce air pollution and what students can do to reduce air pollution
- **Support the Big Q** activity to help students understand how they can make changes in their everyday activities and reduce air pollution
- Review Key Concepts and administer lesson quiz

Lesson 6: Water Pollution and Solutions

- Read **My Planet Diary** as a class
- Students will do the **Inquiry Warm-Up** activity and compete the **After The Inquiry Warm-Up** worksheet
- Introduce vocabulary
- Explain it fresh water is a limited resource because most of the earth's surface water is salt water and not suitable for drinking or watering plants and crops
- Review the terms *pesticide*, *sewage*, and *sediment*
- Explain that most water pollution is the result of human activities, such as waste from agriculture, household, industry, and mining
- Using figure two, ask students to identify the potential sources of water pollution
- Explain that everyone is responsible for water quality and that there are three keys to keeping water clean
- Discuss what individuals and communities can do to properly dispose of hazardous materials and thereby improve water quality
- Review the term *groundwater* before beginning the **apply it activity**
- **Quick Lab** Cleaning Up Oil Spills
- **Explore the Big Q** activity to the students identify the potential sources of air pollution and water pollution
- **Answer the Big Q** to discuss how people can use resources wisely
- Review Key Concepts and administer lesson quiz

Resources:

Interactive Science Program

Vernier Lab Pro™Equipment (Thermometers, pH sensors)

Unit Learning Goal and Scale *(Level 2.0 reflects a minimal level of proficiency)*	
Standard(s): ESS2-6 Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates	
4.0	**Students will be able to:** • In addition to score 3.0 performance, the student demonstrates in-depth inferences and applications that go beyond what was taught.
3.0	**Students will be able to:** • Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates
2.0	**Students will be able to:** • Recognize and recall specific vocabulary (with 80% success): climate, tropical zone, polar zone, temperate zone, marine climate, continental climate, windward, leeward, monsoon,rain forest, savanna, steppe, desert, humid subtropical, tundra, permafrost, ice age, aerosol, sunspot, greenhouse gas, fossil fuel, global warming
1.0	**With help, partical success at level 2.0 content and level 3.0 content:**
0.0	**Even with help, no success**

Standard(s): MS – ESS 3-1: Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.	
4.0	**Students will be able to:** • In addition to score 3.0 performance, the student demonstrates in-depth inferences and applications that go beyond what was taught.
3.0	**Students will be able to:** • Explain how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.
2.0	**Students will be able to:** • Recognize and recall specific vocabulary (with 80% success): Fuel, fossil fuel, hydrocarbon, petroleum, refinery, petrochemical, solar enery hydroelectric power, biomass fuel, gasohol, geothermal energy, nuclear fission, reactor vessel, fuel rod, natural resource, renewable resource, nonrenewable resource, topsoil, groundwater • Describe the relationship between mineral resources and geoscience processes • Describe how the distribution of various resources occurs.
1.0	**With help, partial success at level 2.0 content and level 3.0 content:**
0.0	**Even with help, no success**

Standard(s): MS – ESS 3-3: Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.	
4.0	**Students will be able to:** • In addition to score 3.0 performance, the student demonstrates in-depth inferences and applications that go beyond what was taught.
3.0	**Students will be able to:** • Design a method for monitoring and minimizing a human impact on the environment.
2.0	**Students will be able to:** • Recognize and recall specific vocabulary (with 80% success): Efficiency, insulation, energy conservation, litter, pollutant, point source, nonpoint source, sustainable use, conservation, pesticide, sewage, sediment • Describe how humans have impacted the environment

	• Describe how possible solutions mitigate human impacts
1.0	**With help, partial success at level 2.0 content and level 3.0 content:**
0.0	**Even with help, no success**

Standard(s): MS – ESS 3-4: Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.	
4.0	**Students will be able to:** • In addition to score 3.0 performance, the student demonstrates in-depth inferences and applications that go beyond what was taught.
3.0	**Students will be able to:** • Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.
2.0	**Students will be able to:** • Recognize and recall specific vocabulary (with 80% success): municipal solid waste, incineration, pollutant, leachate, sanitary landfill, recycling, biodegradable, hazardous waste • Describe impacts of the increasing human population and consumption of natural resources.
1.0	**With help, partial success at level 2.0 content and level 3.0 content:**
0.0	**Even with help, no success**

Standard(s): MS – ESS 3-5: Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.	
4.0	**Students will be able to:** • In addition to score 3.0 performance, the student demonstrates in-depth inferences and applications that go beyond what was taught.
3.0	**Students will be able to:** • Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.
2.0	**Students will be able to:** • Recognize and recall specific vocabulary (with 80% success): environmental science, ecological footprint, desertification, drought, emissions • Describe the different factors that have caused the rise in global temperature.
1.0	**With help, partial success at level 2.0 content and level 3.0 content:**
0.0	**Even with help, no success**

Unit Modifications for Special Population Students	
Advanced Learners	Enrichment Worksheets and Scenario Investigations
Struggling Learners	Use L1 Differentiated Instruction Activities
English Language Learners	Use ELL Support Activities from lesson as needed. http://www.state.nj.us/education/modelcurriculum/ela/ELLSupport.pdf
Special Needs Learners	Follow IEP modifications and work with special education teacher to make modifications and use L1 Differentiated Instruction Activities. http://www.nj.gov/education/udl/

Interdisciplinary Connections

Indicators:

ELA:

- Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).
- Write arguments focused on discipline content.
- Draw evidence from informational texts to support analysis, reflection, and research.
- Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.
- Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.
- Gather relevant information from multiple print and digital sources; assess the credibility of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and providing basic bibliographic information for sources.

Math:

- Model with mathematics.
- Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.
- Summarize numerical data sets in relation to their context.
- Recognize and represent proportional relationships between quantities.
- Reason abstractly and quantitatively.
- Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.
- Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.

Integration of 21st Century Skills

Indicators:

To function in the 21st Century work place a variety of skills need to be developed and strengthened some of those would be:

• Developing and Using Models
• Planning and Carrying Out Investigations [supported in the science lab setting but useful in many aspects of life]
• Constructing Explanations and Designing Solutions [supporting explanations with research and experimentation]
• Engaging in Argument from Evidence
• Analyzing and Interpreting Data [collected during labs or proposed scenarios]
• Creativity and Innovation [brainstorm, collaborate and incorporate group ideas]
• Critical Thinking and Problem Solving [Follow the steps of the scientific method.]
• Communication and Collaboration [All types of communication are needed - oral, written and nonverbal communication in a variety of forms and contexts. It is also importanat to be able to listen effectively to decipher meaning, including knowledge, values, attitudes and intentions.]
• Information Literacy [Use information accurately and creatively for the issue or problem at hand.]
• Media Literacy [Apply a fundamental understanding of the ethical/legal issues surrounding the access and use of media.]
• ICT (Information, Communications and Technology) Literacy [Use technology as a tool to research, organize, evaluate and communicate information.]
• Flexibility and Adaptability [Adapt to varied roles, jobs and responsibilities, schedules and contexts.]
• Initiative and Self-Direction [Set goals, balance short-term and long-term goals. Utilize time and manage workload efficiently. Monitor, define, prioritize, and complete tasks without direct oversight. Demonstrate commitment to learning as a lifelong process. Reflect critically on past experiences to continue to improve.]
• Social and Cross-Cultural Skills [Know when it is appropriate to listen and when to speak. Conduct themselves in a respectable manner. Learn and respect cultural differences and work effectively with people from a range of social and cultural backgrounds. Respond open-mindedly to different ideas and values.]
• Productivity and Accountability Set and meet goals, even in the face of obstacles.]

• Leadership and Responsibility [Use interpersonal and problem-solving skills to influence and guide others toward a goal. Inspire others to reach their very best via example and selflessness. Demonstrate integrity and ethical behavior in using influence and power. Act responsibly with the interests of the larger community in mind.]

Unit Title: Physical Science

Unit Description: Students will be introduced to physical science concepts. The students will learn about the forms of energy. Then, a concentration on thermal energy and heat, followed by an introduction to waves, including properties and interactions of waves. Students will explore the nature of sound. The students will learn about the electromagnetic waves including the electromagnetic (EM) spectrum. The unit concludes with an exploration of light and color.

Unit Duration: about nineteen weeks

Desired Results

Standard(s):

Energy – MS-PS3-1

Thermal Energy and Heat – MS-PS3-3

Characteristics of Waves – MS-PS4-1

Sound – MS-PS4-1

Electromagnetic Waves – MS-PS4-2

Light MS-PS4-2

Indicators:

PS3.A Definitions of Energy; PS3.C Relationship Between Energy and Force

PS3.A Definitions of Energy; PS3.D Energy in Chemical Processes

PS4.A Wave Properties

PS4.A Wave Properties

PS4.A Wave Properties; PS4.B Electromagnetic Radiation

PS4.A Wave Properties; PS4.B Electromagnetic Radiation

Understandings:

Students will…

Chapter 5

Lesson 1

- Use mathematical representations to explain how energy, work, and power are related.
- Develop and use models to describe the two basic types of energy

Lesson 2

- Use mathematical representations to explain how to determine an object's mechanical energy.
- Gather and synthesize information to compare and contrast other forms of energy

Essential Questions:

Chapter 5 – Energy
How is energy conserved in a transformation?
Chapter 6 – Thermal Energy and Heat
How does heat flow from one object to another?
Chapter 7 – Characteristics of Waves
What are the properties of waves?
Chapter 8 – Sound
What determines the pitch and loudness of sound?
Chapter 9 – Electromagnetic Waves
What kinds of waves make up the electromagnetic spectrum?
Chapter 10 – Light

Lesson 3 • Construct a scientific explanation based on evidence to describe how different forms of energy are related. • Apply scientific ideas to explain the law of conservation of energy *Chapter 6* *Lesson 1* • Gather and synthesize information to explain what temperature is and how it is measured. • Apply scientific ideas to explain how heat is related to temperature and thermal energy *Lesson 2* • Apply scientific principles to compare and contrast the three forms of heat transfer. *Lesson 3* • Conduct an investigation using heat conductors and insulators to examine how materials respond to heat. *Chapter 7* *Lesson 1* • Apply scientific principles to explain what causes mechanical waves. • Develop and use models to describe three types of mechanical waves. *Lesson 2* • Apply scientific principles to describe the basic properties of waves. • Use mathematical representations to explain how a wave's speed is related to its wavelength and frequency *Lesson 3* • Develop and use a model to describe how reflection, refraction, and diffraction change a wave's direction. • Develop and use a model to describe different types of interference. • Gather and synthesize information to explain how standing waves form. *Chapter 8* *Lesson 1* • Apply scientific principles to define sound. • Use mathematical representations to identify factors that affect the speed of sound. *Lesson 2* • Apply scientific principles to identify what the pitch of a sound depends on. • Gather and synthesize information to identify factors that affect the loudness of a sound. • Construct an explanation for what causes the Doppler effect. *Lesson 3* • Gather and synthesize information to identify what determines the sound quality of a musical instrument. *Lesson 4* • Apply scientific principles to describe the function of the human ear. *Lesson 5* • Father and synthesize information to describe how animals and people use sound.	How does light interact with matter?

Chapter 9
Lesson 1
- Gather and make sense of information about electromagnetic waves.
- Students will use models to explain the behavior of electromagnetic waves.

Lesson 2
- Apply scientific principles to explain how electromagnetic waves are alike and how they are different.
- Develop and use models to describe the waves that make up the electromagnetic spectrum.

Lesson 3
- Integrate qualitative scientific and technical information to explain how radio waves transmit information.
- Gather and synthesize information to explain how cell phones work.
- Apply scientific ideas to explain how communications satellites work.

Chapter 10
Lesson 1
- Apply scientific principles to describe what determines the color of an opaque, transparent, or translucent object.
- Construct an explanation for how mixing pigments is different from mixing light.

Lesson 2
- Apply scientific principles to identify the kinds of reflection.
- Develop and use a model to describe the types of images produced by plane, concave, and convex mirrors.

Lesson 3
- Use scientific principles to explain why light rays bend when they enter a medium at an angle.
- Construct an explanation for what determines the types of images formed by convex and concave lenses.

Lesson 4
- Apply scientific principles to explain how one sees objects.

Lesson 5
- Gather and synthesize information to explain how cameras, telescopes, and microscopes work U

Assessment Evidence

Performance Tasks:

- Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.
- Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system

Other Evidence:

Lesson quizzes, Chapter Tests, Labs

Performance Assessments

Chapter 5 Lab: Can You Feel the Power

Chapter 6 Lab: Build Your Own Thermometer

Chapter 7 Lab: Making Waves

Chapter 8 Lab: Changing Pitch

Chapter 9 Lab: Build a Crystal Radio

• Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object. • Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer • Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample. • Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave. • Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials. • Integrate qualitative scientific and technical information to support the claim that digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information than analog signals.	Chapter 10 Lab: Changing Colors

Benchmarks: To be determined

Learning Plan

Learning Activities:

Chapter 5: Energy

- **Introduce the Big Q** and students will answer the question
- Watch **Untamed Science Video** "The Potential for Fun"
- Preview vocabulary
- Complete scenario investigation stuck at that top

Lesson 1: What is Energy?

- Read **My Planet Diary** as a class Wind Farms
- Students will do the **Inquiry Warm-Up activities** and complete the **After The Inquiry Warm-Up** worksheet
- Introduce vocabulary
- Discuss the relationship between the height in which a ball is dropped to its bounce
- Examine how power and energy are related
- Use formula for kinetic energy
- **Support the Big Q**: Compare and contrast and kinetic energy and potential energy
- Show examples of energy transfer
- **Quick Lab**: Mass, velocity, and Kinetic energy
- **Directed Inquiry Lab**: Can You Feel the Power?
- Review Key Concepts and administer lesson quiz

Lesson 2: Forms of Energy

- Read **My Planet Diary** as a class Power of a hurricane
- Students will do the **Inquiry Warm-Up** activity and compete the **After The Inquiry Warm-Up** worksheet
- Introduce vocabulary
- Calculate mechanical energy
- **Quick Lab**: Determining Mechanical Energy
- Describe how potential and kinetic energy changes with motion

- **Apply It Activity**
- Compare different forms of energy and relate it to the movement of particles
- **Support the Big Q**: Express every situation where energy changes form
- **Quick Lab**: Source of energy
- **Virtual Lab**: Forms of Energy
- Review Key Concepts and administer lesson quiz

Lesson 3: Energy Transformations and Conservation

- Read **My Planet Diary** as a class (Energy transformations in an amusement park)
- Students will do the **Inquiry Warm-Up** activity and compete the **After The Inquiry Warm-Up** worksheet
- Introduce vocabulary
- Identify examples of energy transformation
- **Apply It Activity**
- Discuss importance of chemical transformations to our lives
- **Quick Lab**: Soaring Straws
- Explain the law of conservation of energy
- **Explore the Big Q**: Demonstrate that energy is conserved during transformations
- **Quick Lab**: Law of conservation of energy
- Review and administer chapter assessment

Chapter 6: Thermal Energy and Heat

- **Introduce the Big Q** and students will answer question
- Watch Untamed Science video “Why is this Inner Tube So Hot?"
- Preview vocabulary
- Complete Scenario Investigation **Where is the Battery?**

Lesson 1: Fossil Fuels

- Introduce vocabulary
- Read **My Planet Diary** as a class
- Students will do the **Inquiry Warm-Up** activity and complete the **After the Inquiry Warm-Up** Worksheet
- Explain the terms heat, temperature, and kinetic energy
- Use figure one to discuss the scales used to measure temperature
- Discuss how temperature and the kinetic energy are related to thermal energy
- **Apply it Activity**
- **Support the Big Q** to model how heat is transferred between objects
- **Quick Lab**: *Temperature and Thermal Energy* (using Vernier Lab Pro)
- Review Key Concepts and administer lesson quiz

Lesson 2: The Transfer of Heat

- Introduce vocabulary
- Read **My Planet Diary** as a class
- Students will do the **Inquiry Warm-Up** Activity and complete the **After the Inquiry Warm-Up** Worksheet
- Explain that heat flows from the warmer object to the cooler object
- Use figure one to identify and compare different ways that heat can be transferred
- **Explore The Big Q** by finding examples of heat transfer by conduction, radiation, and convection in the beach scene
- **Apply it Activity**
- **Answer The Big Q** and share responses
- **Virtual Lab:** Solar Oven Design
- Review Key Concepts and administer lesson quiz

Lesson 3: Thermal Properties

- Introduce vocabulary
- Read **My Planet Diary** as a class
- Students will do the **Inquiry Warm-Up** activity and complete the **After the Inquiry Warm-Up** Worksheet (using Vernier Lab Pro)
- Describe big difference between insulators and conductors
- **Support the Big Q** by explaining that a coat is an insulator
- Tell students that different amounts of thermal energy are necessary to change the temperature of different objects
- Activity: **Do the Math**
- Identify situations in which substances expand and contract
- Use figure two to illustrate the importance of considering expansion joints when designing certain objects

- **Quick Lab**: Frosty Balloons
- Review Key Concepts and administer lesson quiz

Chapter 7: Characteristics of Waves

- **Introduce the Big Q** and students will answer the question
- Watch untamed science video Extreme Wave Science
- Preview vocabulary
- Complete scenario investigation Rogue wave

Lesson 1: What are Waves?

- Read **My Planet Diary** as a class The power of waves
- Students will do the **Inquiry Warm-Up** activities and complete the **After The Inquiry Warm-Up** worksheet
- Discuss waves and energy
- Explain how mechanical waves form
- **Quick Lab**: What causes mechanical waves?
- Explain the three types of mechanical waves
- **Support the Big Q:** Examine the motion in a transverse wave
- Examine longitudinal waves
- **Apply It Activity**
- **Quick Lab**: Three types of waves
- **Lab**: Making Waves: Wave Interaction
- Review Key Concepts and administer lesson quiz

Lesson 2: Properties of Waves

- Read **My Planet Diary** as a class (The Sound of Romance)
- Students will do the **Inquiry Warm-Up** activity and compete the **After The Inquiry Warm-Up** worksheet
- Discuss the relationship between the height of a wave's crest and its amplitude
- Introduce vocabulary
- Explain the four common properties of waves
- Define and measure the amplitude of a wave
- Determine the frequency of a wave
- **Quick Lab**: Properties of Waves
- **Virtual Lab**: Making Waves
- Calculate the speed of a wave
- **Explore the Big Q** by determining the four basic properties of a wave
- Determine the frequency of a wave
- **Quick Lab**: What Affects the Speed of a Wave?
- Review Key Concepts and administer lesson quiz

Lesson 3: Interactions of Waves

- Read **My Planet Diary** as a class (The Fall of Galloping Gertie)
- Students will do the **Inquiry Warm-Up** activity and compete the **After The Inquiry Warm-Up** Worksheet
- Introduce vocabulary
- Explain how waves can change direction
- Discuss refraction and diffraction
- **Apply It Activity**
- Explain how/when interference occurs
- **Support the Big Q** by discussing how constructive and destructive interference causes changes in amplitude
- **Quick Lab**: Wave interference
- Explore how incoming and reflected waves can form a standing wave
- **Quick Lab**: Standing Waves
- Explore how destructive interference causes nodes and constructive interference causes antinode
- Review and administer chapter assessment

Chapter 8: Sound

- **Introduce the Big Q** and students will answer question
- Watch Untamed Science video “Was That a Whale I Heard?"
- Preview vocabulary
- Complete Scenario Investigation **Seeing With Your Ears**

Lesson 1: The Nature of Sound

- Introduce Vocabulary

- Read **My Planet Diary** as a class
- Students will do the **Inquiry Warm-Up** activity and complete the **After the Inquiry Warm-Up** Worksheet
- Explain that sound is a disturbance that travels as a longitudinal wave
- Discuss how all sounds begin as a vibration
- **Quick Lab**: Understanding Sound
- Explain that the speed of sound depends on three factors: temperature, stiffness, and the density of the medium through which the sound travels
- Discuss about the speed of sound relative to the speed of light
- **Support the Big Q** by discussing that the speed of sound is determined by measuring how fast the eave moves from one place to another
- **Quick Lab:** Ear to the Sound
- Review Key Concepts and administer lesson quiz

Lesson 2: Properties of Sound

- Introduce Vocabulary
- Read **My Planet Diary** as a class
- Students will do the **Inquiry Warm-Up** activity and complete the **After the Inquiry Warm-Up** Worksheet
- Discuss the relationship between amplitude and loudness
- Explain the pitch of a sound depends on frequency
- **Directed Inquiry:** Changing Pitch
- Explain that the loudness of a sound depends on the energy and intensity of the sound wave
- Discuss to make sure that students understand that the decibel scale expresses increases in intensity in power of 10
- **Apply it Activity**
- **Quick Lab**: Listen to This
- Explain the Doppler effect
- **Explore The Big Q** by discussing the three kinds of energy used in headphones: electrical, magnetic, and sound
- **Answer The Big Q** by discussing the factors that determine the pitch and loudness of a sound
- Review Key Concepts and administer lesson quiz

Lesson 3: Music

- Introduce Vocabulary
- Read **My Planet Diary** as a class
- Students will do the **Inquiry Warm-Up** activity and complete the **After the Inquiry Warm-Up** Worksheet
- Explain that sound quality is the characteristic that allows you to distinguish one a musical instrument from another by sound alone
- **Apply it Activity**
- Explore the idea that a short air column produces high frequency sound waves in a whistle
- **Support the Big Q** by explaining how pitch is adjusted on a slide trombone and contrast that instrument with a clarinet
- **Quick Lab**: How Can You Change Pitch?
- Review Key Concepts and administer lesson quiz

Lesson 4: Hearing Sound

- Introduce Vocabulary
- Read **My Planet Diary** as a class
- Students will do the **Inquiry Warm-Up** Activity and complete the **After the Inquiry Warm-Up** Worksheet
- Explain that the ear collects sound waves, changes them into information the brain can use, and sends that information to the brain
- **Apply it Activity**
- Explore the structures of the year using figure one
- **Support the Big Q** by discussing how pitch and volume affect the eardrum
- Discuss how both a hearing aid and cochlear implant bypass work
- Review Key Concepts and administer lesson quiz

Lesson 5: Using Sound

- Introduce Vocabulary
- Read **My Planet Diary** as a class
- Students will do the **Inquiry Warm-Up** Activity and complete the **After the Inquiry Warm-Up** Worksheet
- Explain that dolphins, bats, and some other animals use reflected sound waves to navigate and find feed
- **Support the Big Q** by discussing ultrasound and comparing the frequency of the sounds a bat can hear with the frequencies a human can hear
- Discuss what happens to sound waves when they strike an object

- Explain how people use echolocation in sonar and ultrasound imaging
- **Apply it Activity**
- **Quick Lab**: Designing Experiments
- Review Key Concepts and administer lesson quiz

Chapter 9: Electromagnetic Waves

- **Introduce the Big Q** and students will answer the question
- Watch **untamed science video** The Day the Waves Died
- Preview vocabulary
- Complete scenario investigation Catching the Waves

Lesson 1: The Nature of Electromagnetic Waves

- Read **My Planet Diary** as a class Justin's Blog
- Students will do the **Inquiry Warm-Up Activities** and complete the after the **Inquiry Warm-Up** worksheet
- Introduce vocabulary
- Explain the characteristics of electromagnetic waves
- **Support the Big Q** by identifying the seven types of electromagnetic waves
- Discuss the direction of waves
- Explain to students that the two fields vibrate at right angles to one another
- **Quick Lab**: What is an Electromagnetic wave made of? (using Vernier Lab Pro)
- Examine how wave and particle behavior need to be illustrated using two different models
- Explore how an automatic door opens using the photoelectric effect
- **Apply It Activity**
- **Quick Lab**: Waves or Particles?
- **Virtual Lab**: Models of Light
- Review Key Concepts and administer lesson quiz

Lesson 2: Waves of the Electromagnetic Spectrum

- Read **My Planet Diary** as a class Hey, Where Did It Go?
- Students will do the **Inquiry Warm-Up Activities** and complete the after the **Inquiry Warm-Up** worksheet
- Introduce vocabulary
- Compare different types of electromagnetic waves
- Discuss what causes wavelengths to change
- **Quick Lab**: Differences between Waves
- Review seven waves in the electromagnetic spectrum
- Explore the characteristics of radio waves and microwaves
- Compare wavelength and identify visible light
- Student will complete the **Apply It Activity**
- Identify the properties of infrared rays
- Show students how to read a thermogram
- Discuss the wavelengths and frequencies of colors of light
- Discuss ultraviolet rays
- Identify why X-rays are used to make images of bones and teeth
- Explore the properties of gamma rays
- Students will complete the electromagnetic spectrum
- **Quick Lab**: Parts of the Electromagnetic Spectrum
- **Answer the Big Q** and share responses
- Review Key Concepts and administer lesson quiz

Lesson 3: Wireless Communication

- Read **My Planet Diary** as a class Teens and Their Cell Phones
- Students will do the **Inquiry Warm-Up Activities** and complete the after the **Inquiry Warm-Up** worksheet
- Introduce vocabulary
- Explain how antennas are used for radio broadcasting
- Discuss the differences between AM and FM radio broadcasting
- Describe how the electromagnetic waves used in radio broadcasting compare to the other waves in the electromagnetic spectrum
- **Directed Lab**: Build a Crystal Radio
- Explore how cell phones use microwaves to transmit information
- **Quick Lab**: How Cell Phones Work
- Compare and Contrast satellite communication to cell phones
- Discuss how GPS works (possible **Quick Lab**)

- Review and administer chapter assessment

Chapter 10: Light

- **Introduce the Big Q** and students will answer question
- Watch Untamed Science video “Why is the Ocean Blue?"
- Preview vocabulary
- Complete STEM Activity **Optical Security**

Lesson 1: Light and Color

- Introduce Vocabulary
- Read **My Planet Diary** as a class
- Students will do the **Inquiry Warm-Up** activity and complete the **After the Inquiry Warm-Up** Worksheet
- Classify materials as transparent, opaque, and translucent
- **Quick Lab**: Developing Hypotheses
- **Support the Big Q** by discussing how the color an apple appears to be is dependent on the light that strikes it as shown in figure two
- **Apply it Activity**
- Explain to students that by mixing the equal amounts of two primary colors secondary colors are created
- Explain which colors must be combined to produce a black pigment
- Use figure three to identify which colors of light are complementary
- Discuss primary and secondary colors of light and pigment
- **Directed Inquiry**: Changing Colors
- Review Key Concepts and administer lesson quiz

Lesson 2: Reflection and Mirrors

- Introduce Vocabulary
- Read **My Planet Diary** as a class
- Students will do the **Inquiry Warm-Up** Activity and complete the **After the Inquiry Warm-Up** Worksheet
- Explain how a regular and diffuse reflections are produced
- **Quick Lab**: Observing
- Describe a virtual image created by a plane mirror
- Explain the shape and focal point of a concave mirror
- Use figure two to illustrate from where the reflected light rays appear to come
- **Support the Big Q** by directing students’ attention to figure three and discuss how parallel rays are reflected by the concave surface of a mirror and where the reflected rays meet
- Describe the images produced by a convex mirror and compare them to the images produced by any plane mirror
- Help students understand how a convex mirror reflects light by observing the diagrams in figure 4a and figure three
- **Virtual Lab**: Virtual Optics
- **Apply it Activity**
- **Quick Lab**: Mirror Images
- Review Key Concepts and administer lesson quiz

Lesson 3: Refraction and Lenses

- Introduce Vocabulary
- Read **My Planet Diary** as a class
- Students will do the **Inquiry Warm-Up** activity and complete the **After the Inquiry Warm-Up** Worksheet
- Explain that if light rays enter at an angle they reflect or bend and can cause you to see something that may not actually be there
- Use figure two to illustrate how different mediums cause light to bend more or less
- Discuss what makes crystals and gemstones sparkle in the sunlight
- **Explore The Big Q** by asking students what causes light to refract and reflex as a rainbow forms
- Discuss why the road appears to shimmer in figure three
- **Quick Lab**: Bent Pencil
- **Support the Big Q** and review
- Explain to students that the type of image formed by a lens depends on the shape of the lens and the position of the object
- Look at figure five to better understand what happens to light rays when the pass through a concave lens
- Compare the images formed by the lens in figure five and the lens in figure six
- Discuss the shape of a convex lenses
- Look at figure seven to see how a convex lens works

- Review the classification of mirrors and how they reflect light
- **Apply it Activity**
- **Quick Lab**: Looking at Images
- Review Key Concepts and administer lesson quiz

Lesson 4: Seeing Light

- Introduce Vocabulary
- Read **My Planet Diary** as a class Misconception
- Students will do the **Inquiry Warm-Up** activity and complete the **After the Inquiry Warm-Up** Worksheet
- Explain how the eyes and brain work together to see objects
- Describe the functions of the iris and cornea
- Students will complete the **Apply It Activity**
- Explore how light travels through the eye
- Discuss the functions of rods and cones
- Identify the relationship between the optic nerve and the brain
- Explain how eyes focus on an object
- Examine the difference between nearsighted and farsighted vision problems and how they are corrected
- **Quick Lab**: True Colors
- Review Key Concepts and administer lesson quiz

Lesson 5: Using Light

- Introduce Vocabulary
- Read **My Planet Diary** as a class F-Numbers
- Students will do the **Inquiry Warm-Up** activity and complete the **After the Inquiry Warm-Up** Worksheet
- Explain how a camera works
- Students will complete the **Apply It Activity**
- Discuss how a telescope works
- Explore how a microscope enlarges an object
- Compare and contrast reflecting and refracting telescopes
- **Quick Lab**: What A View!
- Discuss different optical devices
- Review and administer chapter assessment

Resources:

Interactive Science Program
Vernier Lab Pro™Equipment (Thermometers)

Unit Learning Goal and Scale *(Level 2.0 reflects a minimal level of proficiency)*	
Standard(s): MS-PS3-1. Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object	
4.0	**Students will be able to:** • In addition to score 3.0 performance, the student demonstrates in-depth inferences and applications that go beyond what was taught.
3.0	**Students will be able to:** • Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object
2.0	**Students will be able to:** • Recognize and recall specific vocabulary (with 80% success): energy, kinetic energy, potential energy, gravitational potential energy, elastic potential energy, mechanical energy, nuclear energy, thermal energy, electrical energy, electromagnetic energy, chemical energy, energy transformation, law of conservation of energy • Organize data in a way that facilitates analysis and interpretation. • Identify relationships using a graphical display • Compare linear and non-linear relationships
1.0	**With help, partial success at level 2.0 content and level 3.0 content:**
0.0	**Even with help, no success**

Standard(s): MS-PS-3-3 Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.	
4.0	**Students will be able to:** • In addition to score 3.0 performance, the student demonstrates in-depth inferences and applications that go beyond what was taught.
3.0	**Students will be able to:** • Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.
2.0	**Students will be able to:** • Recognize and recall specific vocabulary (with 80% success): temperature, Fahrenheit scale, Celsius scale, Kelvin scale, absolute zero, heat, convection, convection current, radiation, conduction, conductor, insulator, specific heat, thermal expansion • Describe thermal energy transfer.
1.0	**With help, partial success at level 2.0 content and level 3.0 content:**
0.0	**Even with help, no success**

Standard(s): MS-PS-4-1 Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.	
4.0	**Students will be able to:** • In addition to score 3.0 performance, the student demonstrates in-depth inferences and applications that go beyond what was taught.
3.0	**Students will be able to:** • Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.
2.0	**Students will be able to:** • Recognize and recall specific vocabulary (with 80% success); wave, energy, medium, mechanical wave, vibration, transverse wave, crest, trough, longitudinal

	wave, compression, rarefaction, amplitude, wavelength, frequency, hertz, pitch, loudness, intensity, decibel, Doppler effect, electromagnetic wave, electromagnetic radiation, polarized light, photoelectric effect, photon, electromagnetic spectrum, radio waves, microwaves, radar, infrared rays, thermogram, visible light, ultraviolet rays, X-rays, gamma rays, amplitude modulation, frequency modulation • Describe the relationship between the amplitude and energy of a wave.
1.0	**With help, partial success at level 2.0 content and level 3.0 content:**
0.0	**Even with help, no success**

Standard(s): MS-PS4-2 Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.	
4.0	**Students will be able to:** • In addition to score 3.0 performance, the student demonstrates in-depth inferences and applications that go beyond what was taught.
3.0	**Students will be able to:** • Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.
2.0	**Students will be able to:** • Recognize and recall specific vocabulary (with 80% success): environmental science, ecological footprint, desertification, drought, emissions • Describe the different factors that have caused the rise in global temperature.
1.0	**With help, partial success at level 2.0 content and level 3.0 content:**
0.0	**Even with help, no success**

Unit Modifications for Special Population Students

Advanced Learners	Enrichment Worksheets and Scenario Investigations
Struggling Learners	Use L1 Differentiated Instruction Activities
English Language Learners	Use ELL Support Activities from lesson as needed. http://www.state.nj.us/education/modelcurriculum/ela/ELLSupport.pdf
Special Needs Learners	Follow IEP modifications and work with special education teacher to make modifications and use L1 Differentiated Instruction Activities. http://www.nj.gov/education/udl/

Interdisciplinary Connections

Indicators:

ELA:

- Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
- Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).
- Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.
- Write arguments focused on discipline content.
- Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
- Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.
- Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.
- Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.
- Draw evidence from informational texts to support analysis, reflection, and research.

MATH:

- Reason abstractly and quantitatively.
- Understand the concept of ratio and use ratio language to describe a ratio relationship between two quantities.
- Understand the concept of a unit rate a/b associated with a ratio a:b with b≠0, and use rate language in the context of a ratio relationship.
- Recognize and represent proportional relationships between quantities.
- Know and apply the properties of integer exponents to generate equivalent numerical expressions.
- Use square root and cube root symbols to represent solutions to equations of the form x2=p and x3=p, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that √2 is irrational.
- Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear.
- Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram.
- Write, interpret, and explain statements of order for rational numbers in real-world contexts
- Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation.
- Understand congruence and similarity using physical models, transparencies, or geometry software.
- Summarize numerical data sets in relation to their context.
- Model with mathematics.

Integration of 21st Century Skills

Indicators:

To function in the 21st Century work place a variety of skills need to be developed and strengthened some of those would be:

• Developing and Using Models
• Planning and Carrying Out Investigations [supported in the science lab setting but useful in many aspects of life]
• Constructing Explanations and Designing Solutions [supporting explanations with research and experimentation]
• Engaging in Argument from Evidence
• Analyzing and Interpreting Data [collected during labs or proposed scenarios]
• Creativity and Innovation [brainstorm, collaborate and incorporate group ideas]
• Critical Thinking and Problem Solving [Follow the steps of the scientific method.]
• Communication and Collaboration [All types of communication are needed - oral, written and nonverbal communication in a variety of forms and contexts. It is also important to be able to listen effectively to decipher meaning, including knowledge, values, attitudes and intentions.]
• Information Literacy [Use information accurately and creatively for the issue or problem at hand.]
• Media Literacy [Apply a fundamental understanding of the ethical/legal issues surrounding the access and use of media.]
• ICT (Information, Communications and Technology) Literacy [Use technology as a tool to research, organize, evaluate and communicate information.]
• Flexibility and Adaptability [Adapt to varied roles, jobs and responsibilities, schedules and contexts.]
• Initiative and Self-Direction [Set goals, balance short-term and long-term goals. Utilize time and manage workload efficiently. Monitor, define, prioritize, and complete tasks without direct oversight. Demonstrate commitment to learning as a lifelong process. Reflect critically on past experiences to continue to improve.]
• Social and Cross-Cultural Skills [Know when it is appropriate to listen and when to speak. Conduct themselves in a respectable manner. Learn and respect cultural differences and work effectively with people from a range of social and cultural backgrounds. Respond open-mindedly to different ideas and values.]
• Productivity and Accountability Set and meet goals, even in the face of obstacles.]
• Leadership and Responsibility [Use interpersonal and problem-solving skills to influence and guide others toward a goal. Inspire others to reach their very best via example and selflessness. Demonstrate integrity and ethical behavior in using influence and power. Act responsibly with the interests of the larger community in mind.]