Science Curriculum Grade 5

This curricula and accompanying instructional materials have been developed to align with the NJSLS and in accordance with the NJ Department of Education's guidelines to include: Curriculum designed to meet grade level expectations, integrated accommodations and modifications for students with IEPs, 504s, ELLs, and gifted and talented students, assessments including benchmarks, formative, summative, and alternative assessments, a list of core instructional and supplemental materials, pacing guide, interdisciplinary connections, integration of 21st century skills, integration of technology, and integration of 21st Century Life and Career standards.

About the Standards

In 1996, the New Jersey State Board of Education adopted the state's first set of academic standards called the Core Curriculum Content Standards. The standards described what students should know and be able to do upon completion of a thirteen-year public school education. Over the last twenty years, New Jersey's academic standards have laid the foundation for local district curricula that are used by teachers in their daily lesson plans.

Revised every five years, the standards provide local school districts with clear and specific benchmarks for student achievement in nine content areas. Developed and reviewed by panels of teachers, administrators, parents, students, and representatives from higher education, business, and the community, the standards are influenced by national standards, research-based practice, and student needs. The standards define a "Thorough and Efficient Education" as guaranteed in 1875 by the New Jersey Constitution. Currently the standards are designed to prepare our students for college and careers by emphasizing high-level skills needed for tomorrow's world.

The New Jersey Student Learning Standards include Preschool Teaching and Learning Standards, as well as nine K-12 standards for the following content areas: **21st Century Life and Careers, Comprehensive Health and Physical Education, English Language Arts, Mathematics, Science, Social Studies, Technology, Visual and Performing Arts, World Languages**

The 2020 NJSLS in Science were adopted by the State Board of Education on June 3, 2020. Districts are required to implement it by September 2022. The 2020 New Jersey Student Learning Standards webpage provides links to the 2020 NJSLS and information regarding curriculum implementation dates.

Cape May City Elementary School District Science Curriculum
Science Pacing Guide

Content Area: Science
Our elementary science program is founded upon the New Jersey Student Learning Standards for Science, which emphasizes three dimensions to promote scientific literacy for all student scientists. The core three dimensions of science learning, which are integrated into all science learning activities, are: **Science and Engineering Practices, Disciplinary Core Ideas, and Cross Cutting Concepts.** These three dimensions can also be thought of as, **"what scientists do," "what scientists need to know," and "common themes found throughout all science disciplines."**
To implement these standards and corresponding dimensions, our district utilizes highly interactive and engaging activities. These dynamic activities are categorized into three main units of study. and present hands-on, real-world science experiences matched to the developmental level of students.
Three Main Units of Study:

1. Physical Science,
2. Earth & Space Science, and
3. Life Science

Course Title: Science	**Grade Level: 5**

Unit I:
5-PS1: Matter and its Interactions
Instructional Days: 15
In this unit of study, students will study the Periodic Table and learn that matter is made of particles too small to be seen by developing a model. Students will develop an understanding of the idea that regardless of the type of change that matter undergoes, the total weight of matter is conserved. Students determine whether the mixing of two or more substances results in new substances. The crosscutting concepts of cause and effect and scale, proportion, and quantity are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in planning and carrying out investigations and using mathematics and computational thinking. Students are expected to use these practices to demonstrate understanding of the core ideas. This unit is based on 5-PS1-1, 5-PS1-2, 5-PS1-3 and 5-PS1-4.

Dates for Unit: September to November
Pacing Guide: 15 days

Week 1: **Matter**-structure

Week 2: **Periodic Table**-elements

Week 3: **Compounds-**combining elements, formulas,water

Week 4: **Properties and Changes of Matter-**mass, weight, density, solubility, conductivity, physical, and chemical changes

Week 5: **Compare and Contrast:-**mixtures, solutions, and alloys

Week 6: **Three States of Matter**- changes/Unit Test

Unit II: **5-PS2-1: Motion and Stability: Forces and Interactions** **Instructional Days: 20** In this unit of study students will experiment with forces and interactions. They will learn that objects in contact exert forces on each other (friction, elastic pushes and pulls). Students will experiment with electric, magnetic, and gravitational forces between a pair of objects that do not require that the objects be in contact—for example, magnets push or pull at a distance. They will explore sizes of the forces in each situation depending on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other. The students will study the gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center. Students are also expected to use these practices to demonstrate understanding of the core ideas. This unit is based on 5-PS2-1	**Dates for Unit: November to February** **<u>Pacing Guide: 20 days</u>** Week 1: **Forces & Motion-** Newton's Laws, gravity, Earth's gravitational force, friction, speed, velocity, and acceleration Week 2: **Work-** levers, pulleys, inclined planes, wedges, and screws, Week 3: **Energy and Waves**-magnets, magnetic fields, auroras, potential, kinetic, mechanical waves, pitch, vibration, volume, acoustics, electromagnetic waves, light waves, reflection refraction,fiber optics, and lasers, Week 4: **Temperature and Heat**-thermal energy, heat capacity, conduction, conductor, insulation, radiation, and convection, Week 5: **Electrical Energy/Unit Test**-static, current, circuit, generator, batteries, fuel cells. Voltage, switch, parallel and series circuits
Unit III: **5-PS3-1: Energy Transfer** **5-LS1: From Molecules to Organisms: Structures and Processes** **5- LS2: Ecosystems: Interactions, Energy, and Dynamics** **Instructional Days: 20** In this unit of study students will develop an understanding of the idea that plants get the materials they need for growth chiefly from air and water. Using models, students can describe the movement of matter among plants, animals, decomposers, and the environment, and they can explain that energy in animals' food was once energy from the sun. The crosscutting concepts of energy, matter, systems and system models are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in developing and using models and engaging in argument from evidence. Students are also expected to use these practices to demonstrate understanding of the core ideas. This unit is based on 5-LS1-1, 5-LS2-1, and 5-PS3-1.	**Dates for Unit: February to March** **<u>Pacing Guide: 20 days</u>** Week 1: **Communities and Ecosystems-**formation, population Week 2: **Biomes-distinguishing** factors Week 3: **Cycles in Nature-**food webs, chains, and pyramids, and energy flow through ecosystems Week 4: **Functions of Living Things**:producers, consumers, decomposers Week 5: **Habitats and Niches-**symbiosis, interactions, adaptations, and survival of living things Week 6: **Ecosystem Changes-**balance, adaptations, fossils, climate, and human impact/Unit Test
Unit IV: **5-ESS1-1 and 2: Earth's Place in the Universe** **5-ESS2-1 and 2: Earth's Systems** **5-ESS3-1: Earth and Human Activity** **Instructional Days: 20** In this unit of study, students will be able to develop and graph data to show an understanding of patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky. Students will be able to explain that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from Earth. Students will be able to describe	**Dates for Unit: March to May** **<u>Pacing Guide: 20 days</u>** Week 1: **Graphing Patterns-**seasons, Earth's movement through space, length and direction of shadows, day and night Week 2: **Stars-**the Sun, brightness, seasonal star appearances, light years, magnitude, protostar, galaxies, Milky Way, supernova

ways in which the geosphere, biosphere, hydrosphere, and atmosphere interact. Students will be able to describe and graph data to provide evidence about the distribution of water on Earth. The crosscutting concepts of patterns, cause and effect, and scale, proportion, and quantity are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in analyzing and interpreting data and engaging in argument from evidence. Students are also expected to use these practices to demonstrate an understanding of the core ideas. This unit is based on 5-ESS1-1, 5-ESS1-2, 5-ESS2-1, ESS2-2 and 5-ESS3-1.	Week 3: **Earth's Atmosphere-**structure, interactions of the geosphere, biosphere, hydrosphere, and the atmosphere Week 4: **Water on Earth-**distribution, human interaction, marine biomes, freshwater ecosystems Week 5: **Prep for NJSLA Grade 5 Science Assessment**
Unit V: **3-5-ETS1: Engineering Design** **Instructional Days: 10** In this unit students will be able to define a simple design problem reflecting a need or a want that includes specified criteria. They will compare multiple possible solutions to a problem based on how well each is likely to meet the criteria of solving the problem. Students will plan and carry out fair tests to identify aspects of a model or prototype that can be improved. The crosscutting concepts of how people's needs and wants change over time, as do their demands for new and improved technologies, and how engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands are called out as organizing concepts for the disciplinary core ideas of defining and delimiting engineering problems, as well as developing and optimizing possible solutions. Students are also expected to use these practices to demonstrate an understanding of the core ideas. This unit is based on 3-5-ETS1.	**Dates for Unit: May to June** **Pacing Guide: 10 days** Week 1: **NJSLA Grade 5 Science Assessment** (The timeline could vary.) Week 2: **Engineering Project Research-**define a problem, collaborate, discuss, specify criteria to be met Week 3: **Prototype Trials-** recording data, measurement of speed, distance, and time in flight for paper airplanes, improvements and final design choice Week 4: **Final Design Competition-**teams will compete with their final designs, and compare results, materials used, and how the research and design process helped them to create a final design. **The engineering example provided in this unit utilizes paper airplanes, but the engineering process could be used to develop any type of simple design that works to solve a simple problem. Feel free to choose what works for your class.**
Date Created:	**Board Approved On:** 8/18/22

Note: The number of instructional days is an estimate based on the information available at this time. 1 day equals approximately 42 minutes of seat time. Teachers are strongly encouraged to review the entire unit of study carefully and collaboratively to determine whether adjustments to this estimate need to be made.

Cape May City Elementary School District Grade 5 Science Curriculum

Unit I Overview

Content Area: Science

Unit Title: Unit I
5-PS1: Matter and its Interactions

Target Course/Grade Level: 5

Unit Summary: Learning Goal
In this unit of study, students will demonstrate a knowledge of:

- The Structure of Matter
- Elements and the Periodic Table
- Compounds
- Physical and Chemical Changes of Matter
- Mixtures, Solutions, Alloys
- Three States of Matter and Changes

Interdisciplinary Connections:

- Science, Technology, English / Language Arts, Health, Social Emotional Learning, Mathematics, Social Studies

Career Readiness: Life Literacies and Key Skills Standards:

- Career Readiness, Life Literacies and Key Skills
  - These include critical thinking, problem solving, creativity, innovation, collaboration, teamwork and leadership, cross-cultural understanding, and interpersonal communication and science.
  - Incorporation of relevant technologies as tools as part of instruction (i.e. Chromebooks, Touch screen devices, manipulatives, certified assistive technologies for students with special needs, etc.)
  - Developing effective communication
  - Developing Independent Learning Strategies
- Incorporating Science, Technology, Engineering, and Mathematical themes into daily lesson

Learning Targets:
5-PS1-1 Develop a model to describe that matter is made of particles too small to be seen. [Clarification Statement: Examples of evidence supporting a model could include adding air to expand a basketball, compressing air in a syringe, dissolving sugar in water, and evaporating salt water.] [Assessment Boundary: Assessment does not include the atomic-scale mechanism of evaporation and condensation or defining the unseen particles.]
5-PS1-2 Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved. [Clarification Statement: Examples of reactions or changes could include phase changes, dissolving, and mixing that form new substances.] [Assessment Boundary: Assessment does not include distinguishing mass and weight.]
5-PS1-3 Make observations and measurements to identify materials based on their properties. [Clarification Statement: Examples of materials to be identified could include baking soda and other powders, metals, minerals, and liquids. Examples of properties could include color, hardness, reflectivity, electrical conductivity, thermal conductivity, response to magnetic forces, and solubility; density is not intended as an identifiable property.] [Assessment Boundary: Assessment does not include density or distinguishing mass and weight.]
5-PS1-4 Conduct an investigation to determine whether the mixing of two or more substances results in new substances.

Unit Activity	Suggested Learning Activities
I.	**Science and Engineering Practices:** Developing and Using Models Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions. Develop a model to describe phenomena. (5-PS1-1) Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.

Conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. (5-PS1-4) Make observations and measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon. (5-PS1-3) Using Mathematics and Computational Thinking Mathematical and computational thinking in 3–5 builds on K–2 experiences and progresses to extending quantitative measurements to a variety of physical properties and using computation and mathematics to analyze data and compare alternative design solutions. Measure and graph quantities such as weight to address scientific and engineering questions and problems. (5-PS1-2)
DCI: PS1.A: Structure and Properties of Matter Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model showing that gasses are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects. (5-PS1-1) The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish. (5-PS1-2) Measurements of a variety of properties can be used to identify materials. (Boundary: At this grade level, mass and weight are not distinguished, and no attempt is made to define the unseen particles or explain the atomic-scale mechanism of evaporation and condensation.) (5-PS1-3) PS1.B: Chemical Reactions When two or more different substances are mixed, a new substance with different properties may be formed. (5-PS1-4) No matter what reaction or change in properties occurs, the total weight of the substances does not change. (Boundary: Mass and weight are not distinguished at this grade level.) (5-PS1-2)
Crosscutting Concepts: Cause and effect relationships are routinely identified, tested, and used to explain change. (5-PS1-4) Scale, Proportion, and Quantity Natural objects exist from the very small to the immensely large. (5-PS1-1) Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume. (5-PS1-2), (5-PS1-3) Connections to Nature of Science Scientific Knowledge Assumes an Order and Consistency in Natural Systems Science assumes consistent patterns in natural systems. (5- PS1-2)

Lesson Plan Activity:

Create an Element Tile Bulletin Board! (This could be completed throughout the year. Anytime a student has free-time, they could complete an element for the board, the squares could be given as homework, or used in an ongoing science center to study the elements.)

See Overview: (http://www.mrlundysroom.org/elliotts_elements.html)

1. After studying The Periodic Table, students will use the Internet or other resources available in the library to thoroughly research an element. Students could work individually or in teams to choose more than one element, and eventually students will have created all the squares of the Periodic Table, and will be able to put them together like a puzzle on a wall or bulletin board.

2. Create an 11" x 11" inch Element Tile. Be Creative! Be sure to check the requirements section below before you begin.

ELEMENTS REQUIREMENT SHEET: ELEMENT TILE – *Be sure to include all of the following on your tile.*

1. Element Symbol - Middle 3” high	1 point
2. Element Name – small	1 pt.
3. Atomic Number – upper left	1 pt.
4. Atomic Mass – upper right	1 pt.
5. Is it a solid, liquid or gas?	2 pts.
6. Is it a metal, nonmetal or metalloid?	2 pts.
7. Family Name or Rare Earth Element Series	2 pts.
8. Who discovered it? and When discovered?	6 pts. (3 pts. each)
9. How is it used? (must have 2 ways)	6 pts.

	(3 pts. Each) 10. Physical, chemical Properties or unusual 6 pts. facts (must have 3) (2 pts. each) **Total 28 points** ***Be Creative!*** **The following points will be based on the criteria below:** Neatness (show you care about your work) 2 pts. Legible (must be able to read it!) 2 pt.s Color (use of art supplies, materials) 2 pts. Pictures / Graphics (must have 2) 2 pts. WOW!! (Impress me with your creativity) 4 pts. **Total: 12 points**  **Additional Lesson Plan Activity:** **Milk Soap Rainbow!** **Credit: hmhco.com/90secondscience** **Preview video:** Use this video to engage students in the activity. Video-Rainbow Milk **Materials:** 2 small bowls, ½ to 1 cup of whole milk, Food coloring: blue, yellow, red, and green, liquid dish soap, cotton swabs, 1 medium-sized paper clip, 1 plastic fork **Content Topics:** States of matter, properties of matter, attractive forces, surface tension **Phenomenon Background and Procedure:** **First, ask students questions:** What do you think milk is made of? What are some properties of milk? What do you think would happen if we added food coloring to milk? What would happen to the food coloring in the milk if we added soap to the milk? **Note**: If students do not mention that milk has different fat content in it (1%, 2%, and whole milk), ask, "What kinds of milk can you buy in the store?" If students do not mention that milk is made of water, ask, "Do you think there is any water in the milk?" Follow up with, "What properties do both milk and water have?" Record students' different answers on the board for the group. **After discussion:** 1. Pour the milk into the bowl. 2. Add one drop of each food color—one at a time—in the center of the bowl. 3. Dip a cotton swab into the soap. Then dip the swab into the center of the bowl of milk. (Be sure not to stir the milk with the swab.) Observe the phenomenon and have students record results in a science journal or a piece of paper. **Explain the following to the students:** Milk: Milk is mostly water but contains fat and protein molecules spread evenly throughout it. A mixture where small particles are spread evenly throughout a substance is called a colloid. Surface Tension: Because of electrical forces, molecules in a liquid can be attracted to each other and want to stay together. This is called cohesion. At the surface of an undistributed liquid, molecules can stick together creating a "skin" that is stronger and resists external forces.

	Soap: Soap molecules break up fat into smaller pieces. One end of a soap molecule is attracted to water and the other end is repelled by water. **What's the Science?** Review this after the experiment. What keeps a bowl of liquid together? All of the molecules in a liquid are attracted to each other—a property called cohesion. Molecules at the surface of a liquid are more greatly attracted to the liquid in the container than to the air, causing the molecules to pull together and create a "skin" that is stronger and resists external forces. Milk is a special type of liquid called a colloid. Milk is mostly water, but fat and protein molecules are evenly distributed throughout it. Soap is made from long molecules called surfactants. These molecules have a "head" that is attracted to water molecules, and a "tail" that is repelled by water but attracted to fat molecules. When soap is added to milk, the surfactants reduce the milk's cohesion, which also reduces the surface tension. Suddenly, the food coloring is free to expand across the milk! But what about the swirling colors? The tail parts of the surfactant molecules are attracted to the fat molecules in the milk. As a result, soap molecules surround the fat and send the fat flying across the bowl! This is also how soap breaks apart grease or fat that gets on our hands, and allows it to be washed off. **Draw a Model** • Have students, preferably in small groups, draw a model of what happened to cause the soap to break up the fat in the milk. • Have students examine each others' work and make any necessary revisions to their own models. **Explore Deeper** • Test different liquids with the food coloring and soap, such as vegetable oil, water, soda, tea, or coconut milk. • Have students lower a paperclip into a calm bowl of water or milk slowly, using a fork. While the paper clip is floating, add a drop of dish soap. It will disrupt the surface tension and cause the paper clip to sink.

Gifted and Talented: Enrichment Links and Writing Prompts

Links:
The Interactive Periodic Table
DK Salt Water Density Experiment
DK Science Elements
Drawing on Water-Very engaging for all students
Investigating Water Transformations
"How Does Water Vapor Turn Into a Liquid?"

Writing Prompts:
Draw or write sentences to finish the prompts.
"Are magic potions real?"
"Could you transform something worthless into gold?"
"What do fireworks, rubber, and Silly Putty have in common?"
"Why do some things explode?"
"How can a solid change to a gas?"
"What do you need to add or remove to change matter from one state to another?"
"What is vaporization?"
"How could you separate a mixture of sugar and water?"
"What are the three states of matter, and how do they change?"
"What property of sand makes it settle to the bottom of a jar of liquid?"
"What do you call two elements that combine chemically to form a new substance?"
"Describe a compound that you might use in your house."

"Take the perspective of a solid, liquid, or gas substance that is undergoing a state change. Write a poem to describe that change."
"What is formed when two or more atoms are joined together?"
"Why does a helium balloon float?"
"Explain why water droplets form on the outside of a cold drink, during a hot day."
"Explain what makes solids expand and contract."

At-Risk, Including ELL: Resources to Enhance Understanding

Books: Picture-Perfect Science Lessons Using Children's Books to Guide Inquiry, 3-6, Karen Ansberry and Emily Morgan. NSTA Press, What is Matter?, Don L. Corey, I Can Change Matter, Frances Spencer, Matter Matters, by Super Science, Matter and Change, School Specialty/Delta, The Phases of Matter, Speedy, Motion and Matter, Foss, Experiments with States of Matter, Discover Books, The Nature of Matter, Debra J. Housel, States of Matter, Matt Mullins

Reading A to Z: Most Books are in English and Spanish
Isaac Newton: Matter, Math, and Motion, Level Z
The Icy Tent, Level Q
The Mystery Element, No Level

Video Links:
Physical and Chemical Changes **(Not a video, but very informative.)**
Chemical Changes Fast and Slow
Denser Than You Think
Condensation
Periodic Table Video for Kids

Cape May City Elementary School District Grade 5 Science Curriculum
Unit II Overview

Content Area: Science

Unit Title: Unit II
5-PS2-1: Motion and Stability: Forces and Interactions

Target Course/Grade Level: 5

Unit Summary: Learning Goal
In this unit of study, students will demonstrate a knowledge of:

- Forces & Motion-Newton's Laws, gravity, gravity's effect on Earth, friction, speed, velocity, acceleration
- Work-levers, pulleys, inclined planes, wedges, screws,
- Energy and Waves-magnets, magnetic fields, auroras, potential, kinetic, mechanical waves, pitch, vibration, volume, acoustics, electromagnetic waves, light waves, reflection refraction,fiber optics, lasers,
- Temperature and Heat-thermal energy, heat capacity, conduction, conductor, insulation, radiation, convection,
- Electrical Energy/Unit Test-static, current, circuit, generator, batteries, fuel cells. Voltage, switch, parallel and series circuits

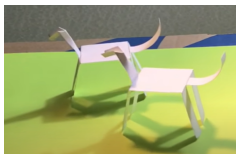
Interdisciplinary Connections:

- Science, Technology, English / Language Arts, Health, Social Emotional Learning, Mathematics, Social Studies

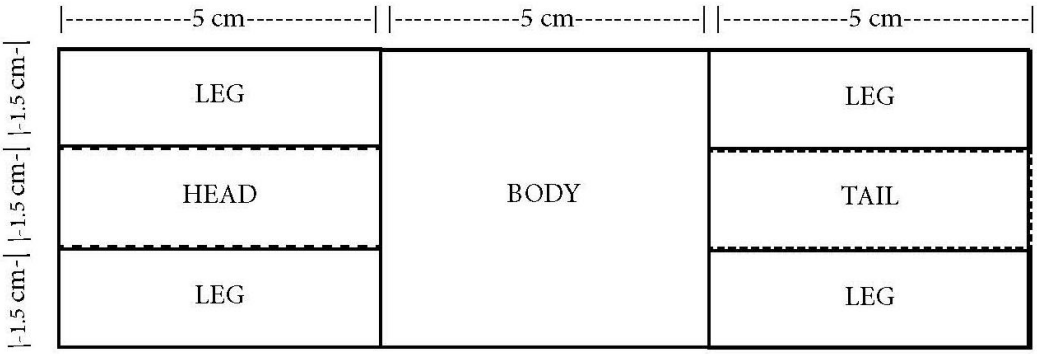
Career Readiness: Life Literacies and Key Skills Standards:

- Career Readiness, Life Literacies and Key Skills
  - These include critical thinking, problem solving, creativity, innovation, collaboration, teamwork and leadership, cross-cultural understanding, and interpersonal communication and science.
  - Incorporation of relevant technologies as tools as part of instruction (i.e. Chromebooks, Touch screen devices, manipulatives, certified assistive technologies for students with special needs, etc.)
  - Developing effective communication
  - Developing Independent Learning Strategies
  - Incorporating Science, Technology, Engineering, and Mathematical themes into daily lessons

Learning Targets:
5-PS2-1 Support an argument that the gravitational force exerted by Earth on objects is directed down. [Clarification Statement: "Down" is a local description of the direction that points toward the center of the spherical Earth.] [Assessment Boundary: Assessment does not include mathematical representation of gravitational force.]

Unit Activity	Suggested Learning Activities
II.	**Science and Engineering Practices:** Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). Support an argument with evidence, data, or a model. (5-PS2- 1) **DCI:** PS2.B: Types of Interactions The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center. (5-PS2-1) **Crosscutting Concepts:** Cause and effect relationships are routinely identified and used to explain change. (5-PS2-1)  **Lesson Plan Activity:** **Walking Horses!** **The Physics Behind the "Walking Horse": https://www.cool-ology.com/** At the top of the hill, the horse has lots of *potential energy*. When given a push, gravity pulls the horse down the hill, turning the *potential energy* into *kinetic energy*. The horse wobbles back and forth, gaining *momentum* as it moves. Did you notice that if your horse gains too much momentum it just slides down your ramp? Too little gravity results in your horse stopping before it reaches the bottom of your ramp. *Friction* plays a part in how fast, how well, your horse moves. Try adding something with more friction to your poster board (for example: felt or a carpet square). Now try adding something to your poster board with less friction (aluminum foil or plastic wrap). Will your horse move down a ramp made of cardboard? Try it! **The Math Behind the "Walking Horse":** The horse itself is made of shapes and angles. Adjusting its geometric parameters even a little bit can add to your success. The ramp can (and should) be moved up and down as you test your horse. Experiment by adding or taking away height and changing the angle for mastery! You must measure accurately to create your horse. Using a ruler correctly is doing math- yay! Can you engineer a different animal to get the same result? What about adjusting the horse so it moves faster or slower? Above all, don't give up!! This activity takes a lot of tweaking and perseverance. Try making little adjustments and move past any feelings of frustration. It's so amazing when it works! Have fun!! **Instructional Video Credit: J. Bell**

Supplies Needed:
Middle weight cardstock paper, scissors, ruler, pencil, box or other flat surface to make a ramp, some books to hold the ramp



Activity:

- **Watch the video in full before starting the project.**

Draw the rectangle for the horse, according to the measurements above or on the video.Trim the feet as shown in the video.Then fold the horse according to the video. Set up the ramp, and experiment with different ramp heights, as you observe the horse. Put the horse at the top of the ramp, and observe how he moves down the ramp due to the force of gravity. Try switching out the surface type on the box to see if it changes the way the horse walks.

- Students will write their observations in a science journal, or a piece of paper, and share them with the class. Observations should include discussions of gravity, kinetic and potential energy, as well as difficulties or changes they had to make during the process.

Gifted and Talented: Enrichment Links and Writing Prompts

Links:
Magnetic Slime
Lift water with an Archemedies' Screw
Investigate pulleys with Lego Blocks
Build an electromagnet
Lego slingshot car building
Fire and Ice Show-Science World
Series and Parallel Circuits with Paul Andersen

Writing Prompts:
Draw or write sentences to finish the prompts.
"What is Newton's Law of Universal Gravitation?"
"Is Earth's mass greater than any object on the face of the Earth?" If so, what is the effect on our earth?"
"What can change an object's motion?"
"How do we use simple machines?"
"What is a compound machine?"
"What forces come from magnets?"
"What is kinetic energy?"
"What is potential energy?"
"How are sounds made?"
"What are the properties of light?"
"How are electromagnetic waves different from mechanical waves?"
"Give an example of refracted light."
"What is thermal energy?"

“Define conduction, convection, and radiation.”
“Tell about conductors and insulators.”
“What is an electric circuit?”
“What is static electricity?”
“How does a generator produce electricity?”
“Compare and contrast parallel and series circuits.”

At-Risk, Including ELL: Resources to Enhance Understanding

Books: Awesome Physics Experiments for Kids: 40 Fun Science Projects and Why They Work (Awesome STEAM Activities for Kids) Part of: Awesome STEAM Activities for Kids (9 Books) | by Erica l. Colón PhD, Mark Twain - Interactive Notebook: Physical Science, Grades 5 - 8, by Schyrlet Cameron and Carolyn Craig, Energy (A True Book: Physical Science, by Jacob Batchelor

Reading A to Z: Most Books are in English and Spanish

Lewis Howard Latimer, Level Y
Issac Newton: Matter, Math, and Motion, Level Z
Faster and Farther: Moving with Force, No Level
Things That Go Bump, No Level
Galileo, Level V
Life in Space, Level Y
The Round Earth, Level Z
The Sun, Earth, and Moon, Level U
Around and Around, No Level
King of the Thrill Rides, No Level
Gravity and Orbits, No Level
So You Want to Go to Mars, Level Z
Electric Cars: History and Future, Level W
Ben Franklin, Level W
Fun by Remote Control, Level X
The Genius of Tesla, Level U
Thomas Edison, Level V
Battery Power, No Level
Working for the Win, No Level
Energy Sources: Pros and Cons, Level Z

Video Links:

Transfer of Energy Marble Activity
Static Electricity Experiments
Magnetic Canon
FunScienceDemos-Series and Parallel Circuits

Cape May City Elementary School District Grade 5 Science Curriculum
Unit III Overview

Content Area: Science

Unit Title: Unit III
5-PS3-1: Energy Transfer
5-LS1-1: From Molecules to Organisms: Structures and Processes
5-LS2-1: Ecosystems: Interactions, Energy, and Dynamics

Target Course/Grade Level: 5

Unit Summary: Learning Goal
In this unit of study students will develop an understanding of:

- the idea that plants get the materials they need for growth chiefly from air and water.
- using models, students can describe the movement of matter among plants, animals, decomposers, and the environment
- energy in animals' food was once energy from the sun

Interdisciplinary Connections:

- Science, Technology, English / Language Arts, Health, Social Emotional Learning, Mathematics, Social Studies

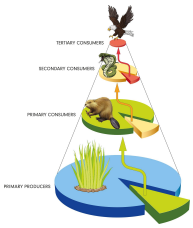
Career Readiness: Life Literacies and Key Skills Standards:

- Career Readiness, Life Literacies and Key Skills
  - These include critical thinking, problem solving, creativity, innovation, collaboration, teamwork and leadership, cross-cultural understanding, and interpersonal communication and science.
  - Incorporation of relevant technologies as tools as part of instruction (i.e. Chromebooks, Touch screen devices, manipulatives, certified assistive technologies for students with special needs, etc.)
  - Developing effective communication
  - Developing Independent Learning Strategies
  - Incorporating Science, Technology, Engineering, and Mathematical themes into daily lessons

Learning Targets:
5-LS1-1 Support an argument that plants get the materials they need for growth chiefly from air and water. [Clarification Statement: Emphasis is on the idea that plant matter comes mostly from air and water, not from the soil.]

5-LS2-1. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment. [Clarification Statement: Emphasis is on the idea that matter that is not food (air, water, decomposed materials in soil) is changed by plants into matter that is food. Examples of systems could include organisms, ecosystems, and the Earth.] [Assessment Boundary: Assessment does not include molecular explanations.]

5-PS3-1. Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun. [Clarification Statement: Examples of models could include diagrams, and flow charts.].

Unit Activity	Suggested Learning Activities
III.	**Science and Engineering Practices:** Developing and Using Models Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions. Use a model to test interactions concerning the functioning of a natural system. (4-LS1-2) Engaging in Argument from Evidence Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). Construct an argument with evidence, data, and/or a model. (4- LS1-1) Developing and Using Models Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions. Use models to describe phenomena. (5-PS3-1) **DCI:** LS1.A: Structure and Function Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. (4-LS1-1) LS1.D: Information Processing Different sense receptors are specialized for particular kinds of information, which may be then processed by the animal's brain. Animals are able to use their perceptions and memories to guide their actions. (4-LS1-2) PS3.D: Energy in Chemical Processes and Everyday Life The energy released [from] food was once energy from the sun that was captured by plants in the chemical process that forms plant matter (from air and water). (5- PS3-1) LS1.C: Organization for Matter and Energy Flow in Organisms Food provides animals with the materials they need for body repair and growth and the energy they need to maintain body warmth and for motion. (secondary to 5-PS3-1) **Crosscutting Concepts:** Systems and System Models A system can be described in terms of its components and their interactions. (4-LS1-1), (4-LS1-2) Energy and Matter Energy can be transferred in various ways and between objects. (5-PS3-1)  **Lesson Plan Activity:** **<u>Walking the Food Web!</u>** **Overview:** A food chain follows the direct path of energy between species. Food webs are more complex and involve a give and take between many organisms in an environment. **<u>Preview Videos:</u>** Food Chain and Food Webs-Study Jams **Walking the Food Web!** (Copyright 2016 The Science Penguin Incorporated All rights reserved by author. Permission to copy for single classroom use only.) Print off the photos and at least 9 arrows from the link below the directions. Set up the food web in a large open space. You can use sidewalk chalk instead of the paper arrows to make the area even larger for your whole class. **Directions:** **Idea #1** Students are each a unit of energy. They begin at Phytoplankton. Leave 3 students at phytoplankton.

The rest move to krill.

At this point, the group separates into 3 groups.

Group #1 moves to jellyfish.

Group #2 moves to the squid.

Group #3 stays at the krill.
Group #1 standing at the jellyfish will separate into two groups.

One stays at the jellyfish and the other moves on to the loggerhead.
Again, separate the group at the loggerhead into 2 groups.

One group stays behind and the other moves to the orca.

Group #2 at the squid separates into 3 groups again.

1/3 go to the orca. 1/3 go to the tuna. 1/3 stays at the squid.

Lastly, half of the group at the tuna goes to the orca and half of the group at the tuna stays there.

Finally, talk about what happens to all of the energy when those organisms die.
Where does it go?
It goes into decomposers!

Break out the bacteria card and have everyone join together again there.

Idea #2 Students are each a unit of energy. Allow students to take any path they choose as long as they follow the arrows. Then, students write about how energy was transferred

Journal or Worksheet Entry: You can copy and paste this to a worksheet.
You are a unit of energy in a food web. Write down each organism you go to and the type of organism: producer, consumer, or decomposer.
organism: _____ type of organism: _____
organism: _____ type of organism: _____
organism: _____ type of organism: _____
organism: _____ type of organism: _____
organism: _____ type of organism: _____
organism: _____ type of organism: _____
Follow-Up 1. The source of energy for phytoplankton is _____.
2. All of the arrows point toward _____ because _____ _____ _____.
3. The arrows in a food web show the _____ _____ _____.

Link to Pictures and Worksheet:
http://thesciencepenguin.com/wp-content/uploads/2016/10/walkingfoodweb2.pdf

Gifted and Talented: Enrichment Links and Writing Prompts

Links:
Short Simple Science Food Chains and Webs
Study Jams Food Chains and Webs

Food Webs
How the Sun Heats the Earth-Fusion
Environmental Studies Consumers, Producers, Decomposers
The Earth as a System
Energy and the Earth
DK Earth-Human Impact
Conservation of Energy and Energy Transfer with Paul Andersen
Newton's Cradle with Paul Andersen
Make Your Own Wet or Dry Terrarium
Flow of Matter and Energy in Ecosystems Read & Quiz
Estuary Energy Flow

Writing Prompts:

Draw or write sentences to finish the prompts.
"Explain the idea that plants get the materials they need for growth chiefly from air and water."
"Using models, describe the movement of matter among plants, animals, decomposers, and the environment."
"How can you show that energy in animals' food was once energy from the sun?"

At-Risk, Including ELL: Resources to Enhance Understanding

Books: Who Eats What?: Food Chains and Food Webs (Let's-Read-and-Find-Out Science 2), by Patricia Lauber, Staying Alive, The Story of a Food Chain,by Jaqui Bailey and Matthew Lilly, Food Webs and Food Chains, Southern Fried Teacher, National Geographic Kids Readers: Animal Homes by Shira Evans, Books for Kids, Habitats Link, Animal Life Cycles, by Joseph Midthun and Samuel Hiti, National Geographic Readers: Seed to Plant Paperback ,by Kristin Rattini

Reading A to Z: Most Books are in English and Spanish

Amazing Adaptations, Level X
Amazing Migrations, Level Z
Symbiotic Wildlife, Level Z
Are GMO's Safe?, Level Z
Dust Bowl Disaster, Level X
Saving the Salmon, Level X

Video Links:

Food Webs
Food Chains as Told by the Lion King
Free School-Food Chains
Explanation of Food Chains and Webs
50 Year old sealed ecosphere
Farming Fish with Vegetables
Air Plants - No Soil Needed
Algae Fuel and Food
Why Do Sunflowers Follow the Sun?
The Ecosystem Song

Cape May City Elementary School District Grade 5 Science Curriculum
Unit IV Overview

Content Area: Science

Unit Title: Unit IV
5-ESS1-1 and 2: Earth's Place in the Universe
5-ESS2-1 and 2: Earth's Systems
5-ESS3-1: Earth and Human Activity

Target Course/Grade Level: 5

Unit Summary: Learning Goal
In this unit of study, students will develop an understanding of:

- patterns of daily changes in length and direction of shadows, day and night
- the seasonal appearance of some stars in the night sky
- differences in the apparent brightness of the Sun compared to other stars is due to their relative distances from Earth
- ways in which the geosphere, biosphere, hydrosphere, and atmosphere interact
- describe and graph data to provide evidence about the distribution of water on Earth.

Interdisciplinary Connections:

- Science, Technology, English / Language Arts, Health, Social Emotional Learning, Mathematics, Social Studies

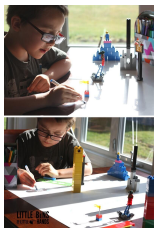
Career Readiness: Life Literacies and Key Skills Standards:

- Career Readiness, Life Literacies and Key Skills
  - These include critical thinking, problem solving, creativity, innovation, collaboration, teamwork and leadership, cross-cultural understanding, and interpersonal communication and science.
  - Incorporation of relevant technologies as tools as part of instruction (i.e. Chromebooks, Touch screen devices, manipulatives, certified assistive technologies for students with special needs, etc.)
  - Developing effective communication
  - Developing Independent Learning Strategies
  - Incorporating Science, Technology, Engineering, and Mathematical themes into daily lessons

Learning Targets:
5-ESS1-1 Support an argument that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from Earth. [Assessment Boundary: Assessment is limited to relative distances, not sizes, of stars. Assessment does not include other factors that affect apparent brightness (such as stellar masses, age, stage).]
5-ESS1-2 Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky. [Clarification Statement: Examples of patterns could include the position and motion of Earth with respect to the sun and selected stars that are visible only in particular months.] [Assessment Boundary: Assessment does not include causes of seasons.]
5-ESS2-1 Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact. [Clarification Statement: Examples could include the influence of the ocean on ecosystems, landform shape, and climate; the influence of the atmosphere on landforms and ecosystems through weather and climate; and the influence of mountain ranges on winds and clouds in the atmosphere. The geosphere, hydrosphere, atmosphere, and biosphere are each a system.] [Assessment Boundary: Assessment is limited to the interactions of two systems at a time.]
5-ESS2-2 Describe and graph the amounts of salt water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth. [Assessment Boundary: Assessment is limited to oceans, lakes, rivers, glaciers, ground water, and polar ice caps, and does not include the atmosphere.].
5-ESS3-1 Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources, environment, and address climate change issues.

Unit Activity	Suggested Learning Activities
IV.	**Science and Engineering Practices:** Analyzing and Interpreting Data Analyzing data in 3–5 builds on K–2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used. Represent data in graphical displays (bar graphs, pictographs and/or pie charts) to reveal patterns that indicate relationships. (5- ESS1-2) Engaging in Argument from Evidence Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). Support an argument with evidence, data, or a model. (5- ESS1-1)

DCI: ESS1.A: The Universe and its Stars The sun is a star that appears larger and brighter than other stars because it is closer. Stars range greatly in their distance from Earth. (5-ESS1-1) ESS1.B: Earth and the Solar System The orbits of Earth around the sun and of the moon around Earth, together with the rotation of Earth about an axis between its North and South poles, cause observable patterns. These include day and night; daily changes in the length and direction of shadows; and different positions of the sun, moon, and stars at different times of the day, month, and year. (5- ESS1-2)
Crosscutting Concepts: Patterns Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena. (5-ESS1-2) Scale, Proportion, and Quantity Natural objects exist from the very small to the immensely large. (5- ESS1-1)


Lego Shadows!
Lesson Plan Activity:

Materials: Lego bricks for the class, a sunny area, paper, rulers, and a journal

Directions: Provide each student a small container of Lego bricks. Give them about 10 minutes to build a Lego person. It can be short or tall, but no bigger than 6 inches tall or wide.

Once the person is complete, have the students place the person in a sunny area of the room or in a special area outside of the classroom designated for this experiment.

It will take all day so you want it to be an undisturbed area.

Then they will take a piece of plain white paper, and draw the shadow of their person. This shadow will be marked with the time of day. Every few hours students will complete this same process of drawing the Lego person's shadow, and recording the time at least three times during the day. 9am, Noon, and 2 pm would be ideal. Students can measure the different sizes of the shadows with a ruler too.

Reflect and Share:
After all the shadow tracings have been completed, gather as a group. Ask,

- *What's different about the morning and afternoon shadows?*
- *At what time of day did we see the longest shadow? The shortest shadow?*
- *Why do you think the shadows changed over the day?*
- *How were the morning and afternoon shadows different?*
- *Did you notice a pattern with the shadow tracings?*
- *How could the length of the shadows tell us about the season?*

After the discussion questions are completed, have students write a one or two paragraph summary about the results of their shadow project. Have the students decorate and color the shadow tracings to hang up around the room. Attach their summaries to the bottom of each picture. You can also use a flashlight at different angles to discuss the background information below, after the experiment.

Important Background Information:

During our summer, the Northern Hemisphere leans toward the Sun in its revolution, there are more daylight hours, and the Sun's angle is more perpendicular to us than at other times of year. The longer days and more concentrated sunlight result in more heating. (Shadows are shorter in the summer because the sun strikes Earth more directly.)

During winter, the Northern Hemisphere leans away from the Sun, there are fewer daylight hours, and the Sun hits us at an angle; this makes it appear lower in the sky. There is less heating because the angled Sun's rays are "spread out" rather than direct. (Shadows are longer because of the lower angle of the Sun.)

In equatorial regions, the length of days and the directness of sunlight don't change as much. The further you get from the equator, the more dramatic the seasonal changes.

During the spring and fall, the Earth leans neither toward or away from the Sun; daylight and nighttime hours are more equal and temperatures are moderate. (The shadow of an object is similar during these seasons.)

Common Misconceptions about the Seasons: Many students (and adults) believe that the Earth is closer to the Sun in the summer and further away in the winter. (It's actually somewhat closer to the Sun in the winter, but the angled rays and short days don't give us much heat.) Another misconception is that the Earth orbits the Sun in an elongated ellipse, which makes the Earth's distance from the Sun dramatically different at different locations. The reality is that the Earth's orbit is nearly circular.

Solstice refers to the two times each year when the Sun's strongest rays are furthest from the equator (north of it during our summer solstice and south during the winter). For the northern hemisphere, summer solstice occurs around June 21st; we have the maximum number of daylight hours at that time. Winter solstice is around December 21st when we have the fewest daylight hours.

Equinox refers to the two times each year when the Sun's strongest rays are directly hitting the equator. Everywhere on Earth has 12 hours of daylight on the spring and fall equinoxes. In the northern hemisphere, spring equinox occurs around March 21st and autumnal equinox around September 21st.

Gifted and Talented: Enrichment Links and Writing Prompts

Links:
Physical Geography: Distribution of Water
How Does the Water Cycle Work?
Experiment for Water Distribution
National Geographic-Water Worlds-Multiple Articles
Pattern Recognition-Paul Andersen
Make Sun S'mores
World of Change-Earth Observatory
NASA Earth Observatory Glossary
Strangest Planets
10 Weird Facts About Earth
10 Strangest Things in the Solar System
About Stars Game and Information-NASA
Sirius-The Brightest Star in the Night
NASA Spaceplace-Multiple Video Links
NOAA SciJinks
NASA Armstrong Flight Research Center
Hubble and the Farthest Star
Climate Kids-Multiple Questions and Answers
Information about the Geosphere, Biosphere, Hydrosphere, and Atmosphere
Total Solar Eclipse

How Do Sundials Work
3D Tour of Constellations
Seeing the Moon During the Day
Compare Sun Sizes
Monster Stars!

Writing Prompts:

Draw or write sentences to finish the prompts.
"What is the brightest star in the night sky? Tell about it!"
"Why do rivers curve?"
"How do sundials work?"
"Why do we see the moon during the day?"
"Describe the patterns you might see with the daily changes in length and direction of shadows, day and night?"
"Tell about the seasonal appearances of stars in the night sky?"
"Describe the differences in the apparent brightness of the Sun, compared to other stars."
"In what ways do the geosphere, biosphere, hydrosphere, and atmosphere interact?"
"What do you know about the distribution of water on Earth?"

At-Risk, Including ELL: Resources to Enhance Understanding

Books: Earth! My First 4.54 Billion Years (Our Universe, 1) Book 1 of 6: Our Universe | by Stacy McAnulty and David Litchfield, The Ultimate Book of Planet Earth Hardcover by Anne-Sophie Baumann (Author), Didier Balicevic (Illustrator), Amazing Earth: The Most Incredible Places From Around The World Hardcover, by DK (Author), Anita Ganeri (Author), The Atmosphere: An Introduction to Meteorology (13th Edition) (MasteringMeteorology Series) 13th Edition, by Frederick K. Lutgens (Author), Edward J. Tarbuck (Author), Dennis G. Tasa (Author),

Reading A to Z: Most Books are in English and Spanish

The Story of Plastic, Level Y
The Sun, Earth, and Moon, Level U
The Sun, Level V
Gravity and Orbits, No Level

Video Links:

The Water Cycle
How Was the Grand Canyon Formed?
Augmented Reality Sandbox -Topography
Why Do Rivers Curve?
Epic Mudslide Caught on Camera
Retreating Glaciers
Glaciers and Landforms
How Much Could Sea Levels Rise?
Climate Change and Antarctica's Ice
How to Make a Cloud in Your Mouth
The Mystery of the Missing Bees
Make an Edible Ocean Ecosystem
No Shadow of Doubt Worksheet
Sunlight and Seasons
Compare Star Sizes

Cape May City Elementary School District Grade 5 Science Curriculum
Unit V Overview

Content Area: Science

Unit Title: Unit V
3-5-ETS1: Engineering Design

Target Course/Grade Level: 5

Unit Summary: Learning Goal
In this unit students will be able to:

- define a simple design problem reflecting a need or a want that includes specified criteria
- compare multiple possible solutions to a problem based on how well each is likely to meet the criteria of solving the problem
- plan and carry out fair tests to identify aspects of a model or prototype that can be improved

Interdisciplinary Connections:

- Science, Technology, English / Language Arts, Health, Social Emotional Learning, Mathematics, Social Studies

Career Readiness: Life Literacies and Key Skills Standards:

- Career Readiness, Life Literacies and Key Skills
  - These include critical thinking, problem solving, creativity, innovation, collaboration, teamwork and leadership, cross-cultural understanding, and interpersonal communication and science.
  - Incorporation of relevant technologies as tools as part of instruction (i.e. Chromebooks, Touch screen devices, manipulatives, certified assistive technologies for students with special needs, etc.)
  - Developing effective communication
  - Developing Independent Learning Strategies
- Incorporating Science, Technology, Engineering, and Mathematical themes into daily lessons

Learning Targets:
3-5-ETS1-1 Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
3-5-ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
3-5-ETS1-3 Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Unit Activity	Suggested Learning Activities
V.	**Science and Engineering Practices**: Asking questions and defining problems in 3–5 builds on grades K– 2 experiences and progresses to specifying qualitative relationships. Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost. (3-5-ETS1-1) Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions. Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. (3-5-ETS1-3) Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems. Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem. (3-5-ETS1-2)

DCI: ETS1.A: Defining and Delimiting Engineering Problems Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (3-5- ETS1-1) ETS1.B: Developing Possible Solutions Research on a problem, such as climate change, should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. (3-5-ETS1-2) At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. (3-5-ETS1-2) Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. (3-5-ETS1-3) ETS1.C: Optimizing the Design Solution Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (3-5-ETS1-3)
Crosscutting Concepts: Influence of Engineering, Technology, and Science on Society and the Natural World People's needs and wants change over time, as do their demands for new and improved technologies. (3-5-ETS1-1) Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands. (3-5-ETS1-2)

 **Lesson Plan Activity:**
Grade 5-Engineering Project-
Build a Better Paper Airplane!

Overview: Students will learn the different airplane parts, including wing, flap, aileron, fuselage, cockpit, propeller, spinner, engine, tail, rudder, elevator. Then each team will build three different paper airplanes, which they will test in three trials, recording flight distance, and time, for each plane. Analysis of these experiments with "model" airplanes and their results help them see and figure out what makes airplanes fly and what can be changed to influence the flying characteristics and performance of airplanes. A final fourth paper airplane will be built using the data from trials to help the students make a final design that should fly the farthest. When every team has a final design, the class should have a competition to see whose team plane flies the farthest. For some additional fun, students could create team names, and certificates could be awarded to each team for different areas of excellence.
Details of the project!
1: Identify the problem to be solved.-Define a simple problem that includes responding to a need or want.

- How can I make a paper airplane fly the farthest?

2: Use scientific knowledge to generate design solutions.-Research the problem, collaborate with your team, and discuss multiple solutions.
In your journal show the following data:

- Show your research from the Internet and/or books about paper airplane designs.
- Tell how you collaborated with others to do the research, Each team member should research at least one possible design.
- Explore researched and alternative ideas for a variety of paper airplane designs as a team, and record the ideas.
- Choose three prototype paper airplanes to create, and test. The team will need to agree on materials and designs for each prototype paper airplane.

3: Describe criteria and constraints and evaluate potential solutions-Your prototype will be developed from the data collected.

- A prototype needs to be built that matches criteria and constraints that you have brainstormed in your journal.
- Each prototype needs to be tested in three trials for speed, distance, and time in flight.
- Design issues and changes needed should be addressed for each paper airplane, and recorded in your science journal.

4: Plan an Investigation-Create a plan for the investigation of the final model that describes different tests.

	• Collect and record data of materials used, speed, distance, and time in flight , from the prototype trials in your journal. • A new improved final paper airplane model should be created from the trial data. • What data did you use to create the final model and why? • Complete three data trials for speed, distance, and quality of flight with your new paper airplane against your best prototype, and record the data. **5: Models/Pictures-**Compare your prototype model, and your new model. • Write a comparison of your best prototype model, and your final model in your journal. • Include photos or drawn pictures of the process in your journal. **6: Conclusion-**Your conclusion needs to address the following questions. • Did your final solution/model solve the problem of engineering a plane with the farthest flight? • What data do you have to support your conclusion? • If you were going to continue this project, what new questions would you ask about solving a different problem for a paper airplane?

Gifted and Talented: Enrichment Links and Writing Prompts

Links:
Define a Problem with Paul Andersen
Developing Possible Solutions with Paul Andersen
Optimizing the Design Solution with Paul Andersen
Interdependence of Science, Engineering, and Technology with Paul Andersen
Influence of STEAM on the World with Paul Andersen
Concept Posters for the Classroom
Solving a Problem with the Washington Monument
Writing Prompts:
Draw or write sentences to finish the prompts.
"Create a simple design solution to a problem, be sure to say how it solves a need or a want in your life."
"Why would you compare multiple possible solutions to a problem?"
"Explain the steps of the engineering process."

At-Risk, Including ELL: Resources to Enhance Understanding

Books: STEAM Kids Book Series**, A**wesome Engineering Activities for Kids: 50+ Exciting STEAM Projects to Design and Build (Awesome STEAM Activities for Kids) Paperback –by Christina Schul, Famous STEM Inventors, by Sumita Mukherjee, The Bridge Will Not Be Gray by Dave Eggers, & Tucker Nichols
Reading A to Z: Most Books are in English and Spanish
The Industrial Revolution, Level Z
Hoover Dam, Level Z
Video Links:
The Engineering Design Process
Build a Catapult
Build a Rubber Band Car

Cape May City Elementary School District Grade 1 Science Curriculum
Evidence of Learning

Specific Formative Assessments Utilized in Daily Lessons:

- Suggested Formative Assessment
- Daily independent practice
- Peer Discussions
- Student Portfolio
- Reading/Writing Conferences
- Self-Evaluations
- Anecdotal Notes
- Open-Ended Responses
- Journal Entries
- Reading Logs
- Exit Tickets

Summative Assessment Utilized throughout Units:

- Performance Task
- Technology Task

Benchmarks:

- Quarterly Benchmarks Generated by the Teacher / Curriculum Committee

Modifications for English Language Learner's [ELL]

- Teacher tutoring
- Peer tutoring
- Online Resources
- Cooperative Learning Groups
- Modified Assignments
- Differentiated Instruction
- Response to Intervention (www.help4teachers.com)
- Provide additional examples and opportunities for additional problems for repetition with visuals and manipulatives
- Picture vocabulary
- Picture books
- Simplified language for understanding
- Reader's Theater
- Modify Homework, Assignments and Assessment (can be oral if necessary)
- Cooperative learning
- Retell stories using props
- Additional Center work focusing on alphabet and HFW
- Additional Phonemic Awareness teaching and practice
- Re-teach alphabet and alphabet sounds
- Sentence frames with word bank and pictures
- Songs
- Total Physical Response
- Picture word wall

Modifications for Special Education Students [IEPs]:

- Follow all IEP accommodations for each student as to meet each student's individual need
- For extra strategies please review list above in the ELL category for students who have IEPs
- Provide instructional breaks / practice chunking
- Circling back to original topic
- Lexile score modifications

Modifications for students with 504s:

- Adhere to the modifications of the 504
- For extra strategies please review list above in the ELL category for students who have IEPs
- Provide instructional breaks / practice chunking
- Circling back to original topic
- Lexile score modifications

Modifications Gifted and Talented Students:
- Advanced Lexile Resources
- Independent Study
- Advanced Assignments

Modifications At-Risk/Basic Skills:
- Teacher tutoring
- Supplemental / Pull Out Teaching
- Peer tutoring
- Cooperative Learning Groups / Centers
- Modified Assignments
- Differentiated Instruction
- Response to Intervention (www.help4teachers.com)
- Provide additional examples and opportunities for additional problems for repetition with visuals and manipulatives
- Picture vocabulary
- Picture books
- Simplified language for understanding
- Reader's Theater
- Modify Homework, Assignments and Assessment (can be oral if necessary)
- Cooperative learning
- Retell stories using props
- Additional Center work focusing on alphabet and HFW
- Additional Phonemic Awareness teaching and practice
- Re-teach alphabet and alphabet sounds
- Sentence frames with word bank and pictures
- Songs
- Total Physical Response
- Picture word wall

Teacher Notes:

- **Career Readiness, Life Literacies, and Key Skills:** Rapid advancements in technology and subsequent changes in the economy have created opportunities for individuals to compete and connect on a global scale. In this increasingly diverse and complex world, the successful entrepreneur or employee must not only possess the requisite education for specific industry pathways but also employability skills necessary to collaborate with others and manage resources effectively in order to establish and maintain stability and independence. This document outlines concepts and skills necessary for New Jersey's students to thrive in an ever-changing world. Intended for integration throughout all K–12 academic and technical content areas, the New Jersey Student Learning Standards- Career Readiness, Life Literacies, and Key Skills (NJSLS-CLKS) provides the framework for students to learn the concepts, skills, and practices essential to the successful navigation of career exploration and preparation, personal finances and digital literacy that rewards innovation, creativity, and adaptation to change.

Project-based Learning Tasks:
- Ongoing student portfolio assessments [created by faculty] to monitor student progress.

Vocabulary:
- In-text vocabulary should be incorporated into every unit. Word journals, vocabulary walls, and/or various other activities should be utilized by the instructor to teach vocabulary.

- Story, key details, retell, describe, main topic, rhyming words, syllables, story elements, character, setting, question, question words, front cover, back cover, title page, narrative, favorite, informational text, rules, connection, discuss, conversation, information, illustrator, author, illustrate, picture

The Research Process:

- The research process must be integrated within each course curriculum. Students will be provided with opportunities to investigate issues from thematic units of study. As the NJSLS indicate, students will develop proficiency with MLA or APA format as applicable.
- https://owl.purdue.edu/owl/research_and_citation/apa_style/apa_formatting_and_style_guide/general_format.html
- https://owl.purdue.edu/owl/research_and_citation/mla_style/mla_formatting_and_style_guide/mla_formatting_and_style_guide.html

Technology:

- Students must engage in technology applications integrated throughout the curriculum, though technology provided by us in their individual classroom, and in our technology centered classrooms.
- BrainPop
- Time for Kids Magazine online
- Scholastic Magazine online
- Google Earth
- Nationalgeographic.com

- **Resources:**
- Ancillary resources and materials used to deliver instruction are included below:
- Learning New Jersey Model Curriculum
- ThinkCentral
- Achieve3000
- Reading A-Z.com
- Abcmouse .com
- EnchantedLearning,Com
- Sing Along Songs
- Scholastic.com
- Bilingualplanet.com
- Frog street
- Press.com
- 122 teachme.com
- Starfall
- www.teacherspayteachers.com
- www.udl.org
- http://www.state.nj.us/education/aps/cccs/ss/
- www.macmillanmh.com –downloadable graphic organizers

- **Career Education & Resources:**
- **NJDOE CTE (https://www.nj.gov/education/cte/)**
- Careers are Everywhere Workbook (https://lmci.state.tx.us/shared/careersareeverywhere.asp)
- Career Bingo (http://www.breitlinks.com/careers/career_pdfs/careerbingo.pdf)
- Vocational Information Center / Career Exploration Guides and Resources for Younger Students (http://www.khake.com/page64.html)

Differentiation Strategies

Differentiation strategies can require varied amounts of preparation time. High-prep strategies often require a teacher to both create multiple pathways to process information/demonstrate learning and to assign students to those pathways. Hence, more ongoing monitoring and assessment is often required. In contrast, low-prep strategies might require a teacher to strategically create process and product choices for students, but students are allowed to choose which option to pursue given their learning profile or readiness level. Also, a low-prep strategy might be focused on a discrete skill (such as vocabulary words), so there are fewer details to consider. Most teachers find that integration of one to two new low-prep strategies and one high-prep strategy each quarter is a reasonable goal.

Low Prep Strategies	
Varied journal prompts, spelling or vocabulary lists	Students are given a choice of different journal prompts, spelling lists or vocabulary lists depending on level of proficiency/assessment results.
Anchor activities	Anchor activities provide meaningful options for students when they are not actively engaged in classroom activities (e.g., when they finish early, are waiting for further directions, are stumped, first enter class, or when the teacher is working with other students). Anchors should be directly related to the current learning goals.
Choices of books	Different textbooks or novels (often at different levels) that students are allowed to choose from for content study or for literature circles.
Choices of review activities	Different review or extension activities are made available to students during a specific section of the class (such as at the beginning or end of the period).
Homework options	Students are provided with choices about the assignments they complete as homework. Or, students are directed to specific homework based on student needs.
Student-teacher goal setting	The teacher and student work together to develop individual learning goals for the student.
Flexible grouping	Students might be instructed as a whole group, in small groups of various permutations (homogeneous or heterogeneous by skill or interest), in pairs or individuals. Any small groups or pairs change over time based on assessment data.
Varied computer programs	The computer is used as an additional center in the classroom, and students are directed to specific websites or software that allows them to work on skills at their level.
Multiple Intelligence or Learning Style options	Students select activities or are assigned an activity that is designed for learning a specific area of content through their strong intelligence (verbal-linguistic, interpersonal, musical, etc.)
Varying scaffolding of same organizer	Provide graphic organizers that require students to complete various amounts of information. Some will be more filled out (by the teacher) than others.
Think-Pair-Share by readiness, interest, and/or learning profile	Students are placed in predetermined pairs, asked to think about a question for a specific amount of time, then are asked to share their answers first with their partner and then with the whole group.

Mini workshops to re-teach or extend skills	A short, specific lesson with a student or group of students that focuses on one area of interest or reinforcement of a specific skill.
Orbitals	Students conduct independent investigations generally lasting 3-6 weeks. The investigations "orbit" or revolve around some facet of the curriculum.
Games to practice mastery of information and skill	Use games as a way to review and reinforce concepts. Include questions and tasks that are on a variety of cognitive levels.
Multiple levels of questions	Teachers vary the sorts of questions posed to different students based on their ability to handle them. Varying questions is an excellent way to build the confidence (and motivation) of students who are reluctant to contribute to class discourse. Note: Most teachers would probably admit that without even thinking about it they tend to address particular types of questions to particular students. In some cases, such tendencies may need to be corrected. (For example, a teacher may be unknowingly addressing all of the more challenging questions to one student, thereby inhibiting other students' learning and fostering class resentment of that student.)
High Prep Strategies	
Cubing	Designed to help students think about a topic or idea from many different angles or perspectives. The tasks are placed on the six sides of a cube and use commands that help support thinking (justify, describe, evaluate, connect, etc.). The students complete the task on the side that ends face up, either independently or in homogenous groups.
Tiered assignment/ product	The content and objective are the same, but the process and/or the products that students must create to demonstrate mastery are varied according to the students' readiness level.
Independent studies	Students choose a topic of interest that they are curious about and want to discover new information on. Research is done from questions developed by the student and/or teacher. The researcher produces a product to share learning with classmates.
4MAT	Teachers plan instruction for each of four learning preferences over the course of several days on a given topic. Some lessons focus on mastery, some on understanding, some on personal involvement, and some on synthesis. Each learner has a chance to approach the topic through preferred modes and to strengthen weaker areas
Jigsaw	Students are grouped based on their reading proficiency and each group is given an appropriate text on a specific aspect of a topic (the economic, political and social impact of the Civil War, for example). Students later get into heterogeneous groups to share their findings with their peers, who have read about different areas of study from source texts on their own reading levels. The jigsaw technique allows you to tackle the same subject with all of your students while discreetly providing them the different tools they need to get there.
Multiple texts	The teacher obtains or creates a variety of texts at different reading levels to assign strategically to students.

Alternative assessments	After completing a learning experience via the same content or process, the student may have a choice of products to show what has been learned. This differentiation creates possibilities for students who excel in different modalities over others (verbal versus visual).
Modified Assessments	Assessments can be modified in a variety of ways – for example by formatting the document differently (e.g. more space between questions) or by using different types of questions (matching vs. open ended) or by asking only the truly essential questions.
Learning contracts or Personal Agendas	A contract is a negotiated agreement between teacher and student that may have a mix of requirements and choice based on skills and understandings considered important by the teacher. A personal agenda could be quite similar, as it would list the tasks the teacher wants each student to accomplish in a given day/lesson/unit. Both Learning contracts and personal agendas will likely vary between students within a classroom.
Compacting	This strategy begins with a student assessment to determine level of knowledge or skill already attained (i.e. pretest). Students who demonstrate proficiency before the unit even begins are given the opportunity to work at a higher level (either independently or in a group).
Literature circles	Flexible grouping of students who engage in different studies of a piece of literature. Groups can be heterogeneous and homogeneous.
Learning Centers	A station (or simply a collection of materials) that students might use independently to explore topics or practice skills. Centers allow individuals or groups of students to work at their own pace. Students are constantly reassessed to determine which centers are appropriate for students at a particular time, and to plan activities at those centers to build the most pressing skills.
Tic-Tac-Toe Choice Board (sometimes called "Think-Tac-Toe"	The tic-tac-toe choice board is a strategy that enables students to choose multiple tasks to practice a skill, or demonstrate and extend understanding of a process or concept. From the board, students choose (or the teacher assigns) three adjacent or diagonal. To design a tic-tac-toe board: - Identify the outcomes and instructional focus - Design 9 different tasks - Use assessment data to determine student levels - Arrange the tasks on a tic-tac-toe board either randomly, in rows according to level of difficulty, or you may want to select one critical task to place in the center of the board for all students to complete.

Curriculum Development Resources/Instructional Materials:

List or Link Ancillary Resources and Curriculum Materials Here:

- New Jersey Student Learning Standards (https://www.nj.gov/education/cccs/)
    - NJSLS Science (https://www.nj.gov/education/modelcurriculum/sci//)

Board of Education Approved Text(s)

Scholastic Magazine
National Geographic for Kids
Time Magazine for Kids

STEMScopes
Reading A to Z