GRADE 5

Science Curriculum

Oradell Public School District

Oradell, NJ

2023

OPS BOE Born on Date: July 2017
Revised on: July 2022
Annual Revision: OPS BOE September 2023

Oradell Public School District

Grade 5 Science Curriculum Committee Credits:

Oradell Public School District

Michael Hagopian
Amy Kennedy
Denise Kuehner
Jenn Powers

Board Policy

This revision is aligned with the New Jersey Student Learning Standards for Science, the New Jersey Student Learning Standards for Computer Science and Design Thinking, the New Jersey Student Learning Standards for Career Readiness, Life Literacies, and Key Skills, and includes connections to Social-Emotional Learning Competencies.

Affirmative Action

During the development of this course of study, particular attention was paid to the elimination or exclusion of any materials which might discriminate on the basis of race, color, national origin, ancestry, age, sex, affectional or sexual orientation, gender identity or expression, marital status, familial status, genetic information, mental or physical disabilities, or in educational opportunities. Every effort has been made to uphold both the letter and spirit of Affirmative Action mandates as applied to the content, the texts and the instruction inherent in this course.

Megan Bozios, Superintendent
Michelle Hawley, Principal
Amy Brancato, Director of Curriculum and Instruction

The Science curriculum was developed by the Oradell School District and aligned to the New Jersey Student Learning Standards (NJSLS).

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Suggested Pacing Guide for Science
Grade 5

Unit	Approximate Months	Unit	Skills
1	Sept-Nov	Life Science	Matter and Energy in Organisms and Ecosystems
2	Nov-Feb	Earth & Space Science	Earth's Systems Climate Change
3	Mar-Apr	Earth & Space Science	Space Systems: Stars and the Solar System
4	May-Jun	Physical Science	Structure and Properties of Matter
Appendix A			3-5 Engineering Design Standards

Grade 5 Science Curriculum

Unit 1: Life Science - Matter and Energy in Organisms and Ecosystems

Unit Overview

Excerpt from NJ State Model Curriculum, Unit 3 - "Unit Summary"

> In this unit of study, students 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 and matter and 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.

Excerpt from NJ State Model Curriculum, Unit 3 - "What it looks like in the classroom"

In every habitat and ecosystem on Earth, plants and animals survive, grow, reproduce, die, and decay. What happens to the matter and energy that are part of each organism? Where does it come from and where does it go? In this unit of study, students make observations and use models to understand how energy flows and matter cycles through organisms and ecosystems.

Students should first understand that plants acquire their material for growth chiefly from air and water. Students will need opportunities to observe a variety of plants over time. As students document plants' continual need for water and air in order to grow, they recognize that this evidence supports the argument that plants acquire their material for growth chiefly from air and water (not from soil). In addition, as students observe that plants also need sunlight, they begin to recognize that plants use energy from the sun to transform air and water into plant matter.

Once students understand that plants acquire material for growth from air and water, they need opportunities to observe animals and plants interacting within an ecosystem. Terrariums, such as those built in 3-liter bottles, are ideal for this because they are large enough for small plants and animals to survive and grow, yet easy to build and maintain. In these terrariums, students should observe plants growing and providing a source of food for small herbivores, carnivores consuming other animals, and decomposers that consume dead plant material.

All of these interactions may not be observable within a single terrarium; however, a class could use a number of 3-liter bottles to set up different ecosystems, each with a few carefully chosen plants and animals. This will give students opportunities to observe different types of interactions within a variety of enclosed systems. When students record their observations of these small systems, it is important that students be able to:

- Identify the living and nonliving components of a system.
- Describe the interactions that occur between the living and nonliving components of each system.
- Develop models (such as food chains or food webs) that describe the movement of matter among plants, animals, decomposers, and the environment.

As students continue to observe each terrarium, they learn that:

- The food of almost any kind of animal can be traced back to plants.
- Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants.
- Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plant parts and animals) and therefore operate as decomposers.
- Decomposition eventually restores (recycles) some materials back to the soil.
- A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life.
- Organisms can survive only in environments in which their particular needs are met.
- Matter cycles between the air and soil and among plants and animals as these organisms live and die.
- Organisms obtain gasses and water from the environment and release waste matter (gas, liquid, or solid) back into the environment.

Furthermore, students can conduct research to determine the effects of newly introduced species to an ecosystem.

After investigating the movement of matter in ecosystems, students revisit the concept of energy flow in systems. At the beginning of this unit of study, students learned that energy from the sun is transferred to plants, which then use that energy to change air and water into plant matter. After observing the interactions between the living and nonliving components of small ecosystems, students recognize that energy, like matter, is transferred from plants to animals. When animals consume plants, that food provides animals with the materials they need for body repair and growth and with the energy they need to maintain body warmth and for motion. Students can use diagrams or flowcharts to describe the flow of energy within an ecosystem, tracing the energy in animals' food back to the energy from the sun that was captured by plants.

With the 2020 updates of the NJSLS for Science to include climate change, in addition to the previous excerpt from the NJ Model Curriculum, students will learn about their role regarding climate change. Students can also observe plant growth using hydroponics, which is growing plants without using soil. This method allows for the control of water which is a natural resource, and can then lead into the concept of vertical farming. Students can use this experiment to promote a positive change in the environment and climate.

Big Idea/Common Thread:

- Plants get the materials they need for growth chiefly from air and water. There is movement of matter among plants, animals, decomposers, and the environment. Energy in animals' food was once energy from the sun.

Enduring Understandings:

- Moving objects contain energy. The faster the object moves, the more energy it has. Energy can be moved from place to place by moving objects, or through sound, light, or electrical currents. Energy can be converted from one form to another form. (PS3.A)
- Food provides animals with the materials and energy they need for body repair, growth, warmth, and motion. Plants acquire material for growth chiefly from air, water, and process matter and obtain energy from sunlight, which is used to maintain conditions necessary for survival. (LS1.C)
- The food of almost any animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants, while decomposers restore some materials back to the soil. (LS2.A)
- Matter cycles between the air and soil and among organisms as they live and die. (LS2.B)

Essential Questions:

- Where do plants get the materials they need for growth?
- How can energy in animals' food be traced to the sun?
- How does matter move among plants, animals, decomposers, and the environment?

Assessments

Possible Ongoing Formative Assessments
● Wrap It Up! Questions ● Various levels of questioning ● Teacher Observation ● Student Participation ● Class Discussions/Partner Talk ● Science Notebook activities ● Performance Expectation Activities: *Investigate; Think Like a Scientist; Think Like an Engineer, STEAM Projects* ● Teacher Rubrics for Performance Expectations Activities ● Hands-on labs
Summative Assessments
● Life Science Unit Assessment
Alternative Assessments

- Modified Life Science Unit Assessment (Less answer choices, highlighted vocabulary, etc.)

Standards (NJSLS) Addressed in this Unit

Disciplinary Core Ideas

- **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)
  - Plants acquire their material for growth chiefly from air and water. (5-LS1-1)

- **LS2.A: Interdependent Relationships in Ecosystems**
  - The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as “decomposers.” Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem. (5-LS2-1)

- **LS2.B: Cycles of Matter and Energy Transfer in Ecosystems**
  - Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. Organisms obtain gasses, and water, from the environment, and release waste matter (gas, liquid, or solid) back into the environment. (5-LS2-1)

Crosscutting Concepts

- **Systems and System Models**
  - A system can be described in terms of its components and their interactions. (5-LS2- 1)

- **Energy and Matter**
  - Matter is transported into, out of, and within systems. (5-LS1-1)
  - Energy can be transferred in various ways and between objects (5-PS3-1)

Science and Engineering Practices

- **Developing and Using Models**
  - Use models to describe phenomena. (5-PS3-1)
  - Develop a model to describe phenomena. (5-LS2-1)

- **Engaging in Argument from Evidence**
  - Support an argument with evidence, data, or a model. (5-LS1-1)

Connections to Nature of Science

Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena

- Science explanations describe the mechanisms for natural events. (5-LS2-1)

Computer Science and Design Thinking

8.1.5.DA.2: Compare the amount of storage space required for different types of data
8.1.5.DA.3: Organize and present collected data visually to communicate insights gained from different views of the data.
8.1.5.DA.5: Propose cause and effect relationships, predict outcomes, or communicate ideas using data.
8.2.5.ED.1: Explain the functions of a system and its subsystems.
8.2.5.ED.2: Collaborate with peers to collect information, brainstorm to solve a problem, and evaluate all possible solutions to provide the best results with supporting sketches or models.
8.2.5.ED.3: Follow step by step directions to assemble a product or solve a problem, using appropriate tools to accomplish the task.
8.2.5.ED.4: Explain factors that influence the development and function of products and systems (e.g., resources, criteria, desired features, constraints).
8.2.5.ED.5: Describe how specifications and limitations impact the engineering design process.
8.2.5.ITH.1: Explain how societal needs and wants influence the development and function of a product and a system.
8.2.5.ITH.3: Analyze the effectiveness of a new product or system and identify the positive

and/or negative consequences resulting from its use.
8.2.5.ETW.1: Describe how resources such as material, energy, information, time, tools, people, and capital are used in products or systems.
8.2.5.ETW.2: Describe ways that various technologies are used to reduce improper use of resources.
8.2.5.ETW.3: Explain why human-designed systems, products, and environments need to be constantly monitored, maintained, and improved.
8.2.5.ETW.4: Explain the impact that resources, such as energy and materials used to develop technology, have on the environment.

Career Readiness, Life Literacies, and Key Skills

CAREER AWARENESS, EXPLORATION, PREPARATION, AND TRAINING
● 9.2.8.CAP.10 - Evaluate how careers have evolved regionally, nationally, and globally.

LIFE LITERACIES AND KEY SKILLS
● 9.4.5.CI.1 - Use appropriate communication technologies to collaborate with individuals with diverse perspectives about a local and/or global climate change issue and deliberate about possible solutions (e.g., W.4.6, 3.MD.B.3,7.1.NM.IPERS.6).
● 9.4.5.CI.2 - Investigate a persistent local or global issue, such as climate change, and collaborate with individuals with diverse perspectives to improve upon current actions designed to address the issue (e.g., 6.3.5.CivicsPD.3, W.5.7).
● 9.4.5.CI.3 - Participate in a brainstorming session with individuals with diverse perspectives to expand one's thinking about a topic of curiosity (e.g., 8.2.5.ED.2, 1.5.5.CR1a).
● 9.4.5.CI.4 - Research the development process of a product and identify the role of failure as a part of the creative process (e.g., W.4.7, 8.2.5.ED.6).
● 9.4.5.CT.1 - Identify and gather relevant data that will aid in the problem-solving process (e.g., 2.1.5.EH.4, 4-ESS3-1, 6.3.5.CivicsPD.2).
● 9.4.5.CT.2 - Identify a problem and list the types of individuals and resources (e.g., school, community agencies, governmental, online) that can aid in solving the problem (e.g., 2.1.5.CHSS.1, 4-ESS3-1).
● 9.4.5.CT.4 - Apply critical thinking and problem-solving strategies to different types of problems such as personal, academic, community and global (e.g., 6.1.5.CivicsCM.3).
● 9.4.5.DC.8 - Propose ways local and global communities can engage digitally to participate in and promote climate action (e.g., 6.3.5.GeoHE.1).

PRACTICES
● CLKSP1 - Act as a responsible and contributing community member and employee.
● CLKSP3 - Consider the environmental, social, and economic impacts of decisions.

● CLKSP4 - Demonstrate creativity and innovation.
● CLKSP5 - Utilize critical thinking to make sense of problems and persevere in solving them.

Interdisciplinary Connections:

English Language Arts

Reading - Informational
● RI.5.1 - Quote accurately from a text and make relevant connections when explaining what the text says explicitly and when drawing inferences from the text. (5-LS1-1)
● RI.5.7 - Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (5-PS3-1),(5-LS2-1)
● RI.5.9 - Integrate and reflect on (e.g. practical knowledge, historical/cultural context, and background knowledge) information from several texts on the same topic in order to write or speak about the subject knowledgeably. (5-LS1-1)

Writing
● W.5.1 - Write opinion pieces on topics or texts, supporting a point of view, with reasons and information (5-LS1-1)
● W.5.2 - Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

Speaking and Listening
● SL.5.5 - Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes. (5-PS3-1),(5-LS2-1)

Mathematics

Mathematical Practices
● MP.2 - Reason abstractly and quantitatively. (5-LS1-1),(5-LS2-1)
● MP.4 - Model with mathematics. (5-LS1-1),(5-LS2-1)
● MP.5 - Use appropriate tools strategically. (5-LS1-1)

Measurement and Data
● 5.MD.A.1 - Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real world problems. (5-LS1-1)

Social-Emotional Competencies

- **Self-Awareness**: ability to recognize one's emotions and know one's strengths and limitations
    - Connections:

        - Regular check-ins to share feelings (Oral, Thumbs Up, Thumbs Down, Emojis, etc.)
        - Reflecting on one's learning (Oral, Thumbs Up, Thumbs Down, Pictures, etc.)
        - Mindfulness and relationship with nature. Walk outside.

- **Self-Management**: ability to regulate and control one's emotions and behaviors, particularly in stressful situations
    - Connections:
        - Counting down from 20 to 1, or 10 to 1
        - Playing soft Nature Sounds music
        - GoNoodle - "Melting" Video
        - Use of cool down space in classroom

- **Social Awareness**: ability to take the perspective of others, demonstrate empathy, acknowledge and appreciate similarities and differences, and understand how one's actions influence and are influenced by others
    - Connections:
        - Students helping each other
        - Playing games

- **Relationship Skills**: refers to one's ability to demonstrate prosocial skills and behaviors in order to develop meaningful relationships and resolve interpersonal conflicts
    - Connections:
        - Class discussions
        - Incentives for individual students and small groups

- **Responsible Decision-Making**: refers to the ability to use multiple pieces of information to make ethical and responsible decisions
    - Connections:
        - Class rules and routines
        - Class discussions
        - Following directions
        - Responsible farming techniques

UNIT OBJECTIVES

Students will be able to …

- 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. (5-PS3-1)

[Clarification Statement: Examples of models could include diagrams, and flowcharts.]

Disciplinary Ideas

- Understand that 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).
- Understand that 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.

Crosscutting Concepts

- Recognize that energy can be transferred in various ways and between objects.

Science and Engineering Practices

- Develop models to describe phenomena.

5-PS3-1

Concepts	Students can...

• The energy released from food was once energy from the sun, which was captured by plants in the chemical process that forms plant matter (from air and water).
• Food provides animals with the materials they need for body repair and growth and the energy they need for motion and to maintain body warmth.
• Energy can be transferred in various ways and between objects.
	• 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. Examples of models could include:
	  • Diagrams
	  • Flowcharts
	• Describe how energy can be transferred in various ways and between objects.
	• Use models to describe phenomena.

Students will be able to …

- Support an argument that plants get the materials they need for growth chiefly from air and water. (5-LS1-1)

  [Clarification Statement: Emphasis is on the idea that plant matter comes mostly from air and water, not from the soil.]

Disciplinary Ideas

- Plants acquire their material for growth chiefly from air and water. (5-LS1-1)

Crosscutting Concepts

- Matter is transported into, out of, and within systems. (5-LS1-1)

Science and Engineering Practices

- Support an argument with evidence, data, or a model. (5-LS1-1)

5-LS1-1

Concepts	Students can...
• Plants acquire their material for growth chiefly from air and water. • Matter is transported into, out of, and within systems.	• Support an argument that plants get the materials they need for growth chiefly from air and water. • Describe how matter is transported into, out of, and within systems. • Support an argument with evidence, data, or a model.

Students will be able to …

- Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment. (5-LS2-1)
  [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.]

Disciplinary Ideas

- Understand that the food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. (5-LS2-1)
- Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as “decomposers.” Decomposition eventually restores (recycles) some materials back to the soil. (5-LS2-1)
- Organisms can survive only in diverse and balanced environments in which their particular needs are met. Newly introduced species can damage the balance of an ecosystem. (5-LS2-1)
- Understand that matter cycles between the air and soil and among plants, animals, and

microbes as these organisms live and die. Organisms obtain gases, and water, from the environment, and release waste matter (gas, liquid, or solid) back into the environment. (5-LS2-1)

Crosscutting Concepts

- Recognize that a system can be described in terms of its components and their interactions. (5-LS2- 1)

Science and Engineering Practices

- Develop a model to describe phenomena. (5-LS2-1)

5-LS2-1

Concepts	Students can...
• The food of almost any kind of animal can be traced back to plants. • Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. • Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as *decomposers*. • Decomposition eventually restores (recycles) some materials back to the soil. • Organisms can survive only in environments in which their particular needs are met. • A system can be described in terms of its components and their interactions. • Science explanations describe the mechanisms for natural events.	• Emphasis is on the idea that matter that is not food—such as air, water, decomposed materials in soil—is changed into matter that is food. Examples of systems could include: ○ Organisms ○ Ecosystems ○ Earth • Describe a system in terms of its components and interactions. • Develop a model to describe an ecosystem. • Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

SUGGESTED ACTIVITIES

- Students design and conduct simple experiments using elodea and Bromothymol blue to determine whether plants consume or release carbon dioxide during photosynthesis. Investigating Photosynthesis: Discovering what plants need for photosynthesis

- Water activities- conservation, importance to the growth of plants, etc.

WOW Wonders of Water (Brownie Journey) | Scouts Honor Wiki

- Soda bottle ecosystems Soda Bottle Ecosystems - Misshumblebee's Blog

- Energy Conservation in an Ecosystem This activity helps students understand the flow of energy through an ecosystem and food web.

- Students build a model of a food web showing the relationships between organisms. Weaving the Web

- Yummy Yeast Lab - students grow yeast inside a plastic bag and observe how they decompose different fruits. https://tinyurl.com/m5snxb6

Unit Specific Vocabulary
bacteria: bacteria are certain kinds of one-celled living things. Some bacteria are decomposers. **carbon dioxide:** a gas used in air that is used to make food by photosynthesis **chlorophyll:** chlorophyll is the green pigment in plants that makes it possible for them to make food from carbon dioxide and water. **community:** a community is made up of all the different populations that live and interact in an area. **consumers:** an organism that gets energy by eating other organisms. **decomposer:** a decomposer is an organism that breaks down dead organisms and the waste of living things. **ecosystem:** all the living and nonliving things that interact with each other in an area. **food web:** a food web is a network of food chains that shows how energy moves through an ecosystem. **fungi:** fungi are types of plants, such as molds and mushrooms, that have no chlorophyll and live on the dead and decaying things. Fungi are decomposers. **glucose:** a simple sugar that is an important energy source in living organisms produced during photosynthesis. **hydroponics:** a method of growing plants in water instead of soil. **invasive species:** a species that has been brought to a new place by people and can harm the environment. **nutrients:** a part of food and soil that helps living things stay healthy and grow. **oxygen:** a gas found in air that is produced as waste during photosynthesis.

photosynthesis: the chemical process that green plants use to turn water and carbon dioxide into food when the plant is exposed to light.
population: all the individuals of a species that live in an area.
producer: a living thing that makes its own food.
species: a group of similar living things that can produce offspring who can, in turn, produce offspring.
sunlight: light from the sun
water: A clear, colorless, odorless, and tasteless liquid, H_2O, essential for most plant and animal life.

Instructional Materials and Learning Activities

Core Instructional Materials:

- *National Geographic Exploring Science 5*
- *National Geographic My NG connect Exploring Science 5 Digital Resources*
- *National Geographic Exploring Science through Literacy*
- *Hand2Mind Exploring Science Hands on Kit*

Digital Resources:

- Access the Next Generation Science Standards by Topic - The NGSS standards
- https://tinyurl.com/kuv7ewp - instructional slides about life science concepts and skills
- online simulations
- STEM Resource Finder - online simulations (requires Java)
- http://ngss.nsta.org/Classroom-Resources.aspx - lesson ideas
- http://sciencespot.net/Pages/refdeskNextGen.html - lesson ideas
- Reintroduction of Wolves to Yellowstone Video
- https://www.generationgenius.com/

Supplemental Materials:

- *Delta Science* Readers
- Discovery Education: Streaming Plus & Science Tech Book

Supplemental Resources
STEAM Integration: UNIT 7 - Hunger Games

Leveled Readers:

Level Reader	Below-Level	On-Level	Above-Level
African Savannah	790L	920L	1020L
The Galapagos Islands	840L	910L	1020L

Suggested Modifications

These strategies can be adapted to scaffold for students needing more support or extending the learning for higher level students. Differentiation is accomplished through content, process, product, and learning environment.

NGSS Appendix D - "All Standards, All Students": Making the Next Generation Science Standards Accessible to All Students

Special Education Students
• To help students understand how plants make food, provide them with sentence frames, such as *In photosynthesis, plants capture energy in (sunlight) to make food. Plants use carbon dioxide and (water) to make sugar.* • *Have students work in pairs and use index cards to identify the living and nonliving things in the prairie ecosystem shown on pages 78–79. Have students take turns explaining how the prairie ecosystem meets the needs of the different plants and animals.* • Extended time for assignment • Prompting • Reassurance • Time to formulate ideas • Use of visual clues when reading • Preferential seating • Repeated directions • Instructional Aides in the classroom setting • Peer models • Preview content vocabulary and schema • Use of FM system to improve attention and support auditory information • Behavior chart to increase focus and work completion • Sensory breaks • Chromebook extensions *(text-to-speech)* • Graphic organizers
Students at Risk
• To help students understand how plants make food, provide them with sentence frames, such as *In photosynthesis, plants capture energy in (sunlight) to make food. Plants use carbon dioxide and*

(water) to make sugar.
- *Have students work in pairs and use index cards to identify the living and nonliving things in the prairie ecosystem shown on pages 78–79. Have students take turns explaining how the prairie ecosystem meets the needs of the different plants and animals.*
- Response to intervention - targeted skill/goal improvement plans within a set time frame
- Multisensory manipulatives
- Preferential seating
- Behavior chart to increase focus and work completion
- Use of FM system to improve attention and support auditory information
- Sensory breaks
- Chromebook extensions *(text-to-speech)*
- Leveled texts
- Audio books
- Consultation with academic support teachers to address skills identified by the classroom teacher
- Modification of assignments and assessments
- Splitting up open ended components of assessments into manageable tasks

English Language Learners

- To help students use the words *food chain, producer,* and *consumer* correctly, provide sentence frames such as: *The red-shouldered hawk is part of a desert (food chain).*
- To help students describe food chains, provide sentence stems such as: *A food chain shows how . . . The first organism in a food chain is always a . . . .*
- Help students complete a two-column chart with *Producers* and *Consumers* as headings. Then have students use their charts as aids to explain food chains.
- To help students understand the terms *food web* and *food chain*, provide sentence frames such as: *A single pathway of energy is a (food chain). The grasshopper and the mountain lion are in the same (food web).*
- To help students describe food webs, have them complete sentences such as, *A food web shows how . . .*
- Help students portray a scene that shows how food chains overlap in a food web. Encourage them to portray specific animals that are part of more than one food chain.
- Help students write or dictate labels for the photo on pages 86–87. To help students describe the photo and map on pages 86–87, provide sentence frames, such as *Kudzu vines have covered the (trees) and part of the (house). Kudzu now grows throughout the (southeastern) states. It has also spread to other parts of the (country).* Help students write or dictate complete sentences to describe the photo and map on pages 86–87.
- Collaborate with English Language teacher. Preview content vocabulary *(with pictures and labels in the student's first language)*
- Visual clues (pictures)
- Repeated directions
- Check for understanding
- Ask pointed questions
- Peer models
- English language supports for parents of non English speaking students
- Use of iPad for translation between English and the student's first language

- Materials presented at lower TC levels
- Audio books
- Use of interactive English vocabulary websites *(Learning Chocolate)*
- Small flip book of content specific vocabulary with translations and pictures

Gifted and Talented

- Have students draw flowcharts to describe the process of photosynthesis. Some may be interested in using these chemical formulas in their flow charts: carbon dioxide (CO_2), water (H_2O), oxygen (O_2), and sugar ($C_6H_{12}O_6$).
- Have partners draw the tallgrass prairie shown on pages 78–79 to illustrate how the ecosystem provides food and protection against predators for animals such as the horned lark and burrowing owl.
- Students show how characteristics of the ecosystem that are not visible in the photo, such as air and water, also support the birds and the bison. Have students use simple captions to explain their drawings.
- Challenge questions and higher level thinking while reading both fiction and nonfiction texts
- Higher TC level texts
- Advanced STEAM activities
- Assigned leadership roles within class

Students with 504 Plans

- To help students understand how plants make food, provide them with sentence frames, such as *In photosynthesis, plants capture energy in (sunlight) to make food. Plants use carbon dioxide and (water) to make sugar.*
- Have students work in pairs and use index cards to identify the living and nonliving things in the prairie ecosystem shown on pages 78–79. Have students take turns explaining how the prairie ecosystem meets the needs of the different plants and animals.
- Extended time for assignment
- Prompting
- Reassurance
- Time to formulate ideas
- Use of visual clues when reading
- Preferential seating
- Repeated directions
- Instructional Aides in the classroom setting
- Peer models
- Preview content vocabulary and schema
- Use of FM system to improve attention and support auditory information
- Behavior chart to increase focus and work completion
- Sensory breaks
- Chromebook extensions *(text-to-speech)*
- Graphic organizers

Grade 5 Science Curriculum

Unit 2: Earth & Space Science - Earth's Systems

Unit Overview

Excerpt from NJ State model curriculum, Grade 5, Units 4 and 5 "What it looks like in the classroom"

In this unit of study, students develop models to describe the interactions that occur within and between major Earth systems and conduct research to learn how humans protect the Earth's resources. Students need to understand that Earth is a system made up of subsystems, all of which have multiple components that interact. Throughout this unit, students will consider scale and proportion when examining the amount of water on the Earth, and they will consider the impact that humans have on one of Earth's most valuable resources.

Foundational to this unit of study is the understanding of a system, its components, and the interactions that occur within the system. Initially, students may need opportunities to review familiar examples of systems, such as plants and animals, listing external and internal structures and processes and describing the interactions that occur within the system. Students can then begin to think about Earth's major systems, identifying the components and describing the interactions that occur within each.

For example:

- The geosphere is composed of solid and molten rock, soil, and sediments. Some processes that occur between the components of the geosphere include erosion, weathering, deposition, sedimentation, compaction heating, cooling, and flow. These processes cause continual change to rock, soil, and sediments.
- The hydrosphere is composed of water in all its forms. Water, unlike the vast majority of earth materials, occurs naturally on the Earth as a solid, liquid, or gas, and it can be found on, above, and below the surface of the Earth. Some processes that occur in the hydrosphere include evaporation, condensation, precipitation, runoff, percolation, freezing, thawing, and flow. These processes cause water to change from one form to another in a continuous cycle.
- The atmosphere is a critical system made up of the gases that surround the Earth. The atmosphere helps to regulate Earth's climate and distribute heat around the globe, and it is composed of layers with specific properties and functions. This system, composed mainly of nitrogen, oxygen, argon, and carbon dioxide, also contains small amounts of other gases, including water vapor, which is found in the lowest level of the atmosphere where weather-related processes occur. In addition to weather processes, radiation, conduction, convection, carbon cycling, and the natural greenhouse effect are processes that occur in the atmosphere.
- The biosphere comprises living things, including humans. Living organisms can be found in each of the major systems of the Earth (the atmosphere, hydrosphere, and geosphere). Some processes that occur within the biosphere include transpiration, respiration, reproduction, photosynthesis, metabolism, growth, and decomposition.

Students conduct research, using informational texts and online resources, to determine the distribution of freshwater and saltwater among Earth's oceans, rivers, lakes, glaciers, groundwater, and polar ice caps. Students organize their data into graphs or charts, showing the allocation of freshwater and saltwater on Earth. (Amounts should be described in terms of volume, as well as in percentages.) They should look for examples of human activities in agriculture, industry, and in their everyday lives, and should describe, both orally and in writing, the ways in which these activities affect the land, oceans, streams, groundwater, air, and other organisms (both plants and animals). Students will need the opportunity to share their findings with the class, and then should conduct further research to find ways in which individual communities use science ideas to protect the Earth's resources and environments.

After comparing and analyzing data, students should be able to conclude the following:

- Nearly all of Earth's available water is in the ocean.
- Freshwater makes up less than 3% of the total amount of water on the Earth.
- Most freshwater is found in glaciers or underground.
- Only a tiny fraction of the freshwater on Earth is in streams, lakes, wetlands, and the atmosphere.

As students become more comfortable with describing each system in terms of its components and interactions, they should begin to think about and discuss the interactions that occur between systems. This should be a natural progression in their learning, since students will discover that any interactions that occur within a system affect components of other systems. Students should develop models that describe ways in which any two Earth systems interact and how these interactions affect the living and nonliving components of the Earth.

Some examples include:

- The influence of oceans on ecosystems, landform shape, or climate.
- The impact of the atmosphere on landforms or ecosystems through weather and climate.
- The influence of mountain ranges on wind and clouds in the atmosphere.

As a class, students can brainstorm additional examples. They can use any type of model, such as diagrams or physical replicas, to describe the interactions that occur between any two systems, and they can choose to enhance the model with multimedia components or visual displays.

Once students have an understanding of the components and interactions that occur within and between Earth's major systems, they should gather information about the ways in which individual communities use science ideas to protect Earth's resources and environment. Students can work individually, in pairs, or in small groups to conduct research using books and other reliable media resources. They should paraphrase and summarize information as they take notes, then use their information to support their finished work. Humans are just one of many components in an ecosystem, yet our activities affect all parts of the ecosystem, many times in adverse ways.

Students' research should help them determine:

- How human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space
- What individuals and communities are doing to help protect Earth's resources and the environment.

- Students can share their work in a variety of ways and should provide a list of sources for the information in their finished work.
- Although engineering design is not explicitly called out in this unit, students could incorporate engineering design in a number of ways as they explore human impact on the environment.
- Students may design a way to promote local, sustainable agriculture, making healthy food available to more people in their communities while minimizing the impact on the local environment.
- Students can design and implement a variety of recycling projects that have a positive impact on the environment by increasing the reuse of materials that normally end up in landfills and decreasing our reliance on earth resources.

With the 2020 updates of the NJSLS for Science to include climate change, in addition to the previous excerpt from the NJ Model Curriculum, students will learn about their role regarding climate change. Students are building upon their awareness and understanding of climate change learned in previous grade levels. Students are also promoting the use of renewable resources and energy through various activities and educating others.

Big Idea/Common Thread:

- The geosphere, biosphere, hydrosphere, and/or atmosphere interact in various ways.
- Humans are impacting the Earth in positive and negative ways (e.g. climate change).

Enduring Understanding:

- Four major Earth systems interact. Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, organisms, and gravity break rocks, soils, and sediments into smaller pieces and disperse them. (ESS2.A)
- Most of Earth's water is in the ocean and much of Earth's freshwater is in glaciers or underground (ESS2.C)
- Societal activities have had major effects on land, ocean, atmosphere, and even outer space. Societal activities can also help protect Earth's resources and environments. (ESS3.C)

Essential Questions:

- In what ways do the geosphere, biosphere, hydrosphere, and/or atmosphere interact?
- Where is water found on the Earth and how is it distributed?
- How do individual communities use science ideas to protect the Earth's resources and environment?
- In what ways are individuals and communities reducing their carbon footprint?
- How do individual communities use science ideas to protect the Earth's resources and environment, and reduce the impact of climate change?

Assessments

Possible Ongoing Formative Assessments
• Wrap It Up! Questions • Various levels of questioning • Teacher Observation • Student Participation • Class Discussions/Partner Talk • Science Notebook activities • Performance Expectation Activities: *Investigate; Think Like a Scientist; Think Like an Engineer, STEAM Projects* • Teacher Rubrics for Performance Expectations Activities • Hands-on labs
Summative Assessments
• Earth Systems Science Unit Assessment (Physical Science)
Alternative Assessments
• Modified Earth Systems Science Unit Assessment (Less answer choices, highlighted vocabulary, etc.)

Standards (NJSLS) Addressed in this Unit

Disciplinary Core Ideas

• **ESS2.A: Earth Materials and Systems**
  ○ Earth's major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth's surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather. (5-ESS2-1)
• **ESS2.C: The Roles of Water in Earth's Surface Processes**
  ○ Nearly all of Earth's available water is in the ocean. Most freshwater is in glaciers or underground; only a tiny fraction is in streams, lakes, wetlands, and the atmosphere. (5- ESS2-2)
• **ESS3.C: Human Impacts on Earth Systems**
  ○ Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments **and address climate change issues**. (5-ESS3-1)

Crosscutting Concepts

- **Scale, Proportion, and Quantity**
  - Standard units are used to measure and describe physical quantities such as weight, and volume. (5-ESS2-2)

- **Systems and System Models**
  - A system can be described in terms of its components and their interactions. (5-ESS2- 1),(5-ESS3-1)

Science and Engineering Practices

- **Developing and Using Models**
  - Develop a model using an example to describe a scientific principle. (5-ESS2-1)

- **Using Mathematics and Computational Thinking**
  - Describe and graph quantities such as area and volume to address scientific questions. (5-ESS2-2)

- **Obtaining, Evaluating, and Communicating Information**
  - Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem. (5-ESS3-1)

Connections to Nature of Science

Science Addresses Questions About the Natural and Material World
- Science findings are limited to questions that can be answered with empirical evidence. (5- ESS3-1)

Computer Science and Design Thinking

8.1.5.DA.2: Compare the amount of storage space required for different types of data
8.1.5.DA.3: Organize and present collected data visually to communicate insights gained from different views of the data.
8.1.5.DA.5: Propose cause and effect relationships, predict outcomes, or communicate ideas using data.
8.2.5.ED.1: Explain the functions of a system and its subsystems.
8.2.5.ED.2: Collaborate with peers to collect information, brainstorm to solve a problem, and evaluate all possible solutions to provide the best results with supporting sketches or models.
8.2.5.ED.3: Follow step by step directions to assemble a product or solve a problem, using appropriate tools to accomplish the task.
8.2.5.ED.4: Explain factors that influence the development and function of products and systems

(e.g., resources, criteria, desired features, constraints).
8.2.5.ED.5: Describe how specifications and limitations impact the engineering design process. that may make a technology appropriate and sustainable in one society but not in another.
8.2.5.ETW.1: Describe how resources such as material, energy, information, time, tools, people, and capital are used in products or systems.
8.2.5.ETW.2: Describe ways that various technologies are used to reduce improper use of resources.
8.2.5.ETW.3: Explain why human-designed systems, products, and environments need to be constantly monitored, maintained, and improved.
8.2.5.ETW.4: Explain the impact that resources, such as energy and materials used to develop technology, have on the environment.
8.2.5.ITH.2: Evaluate how well a new tool has met its intended purpose and identify any shortcomings it might have.
8.2.5.ITH.3: Analyze the effectiveness of a new product or system and identify the positive and/or negative consequences resulting from its use.
8.2.5.ITH.4: Describe a technology/tool that has made the way people live easier or has led to a new business or career.
8.2.5.NT.4: Identify how improvement in the understanding of materials science impacts technologies.

Career Readiness, Life Literacies, and Key Skills

PERSONAL FINANCIAL LITERACY
● 9.1.8.CR.4 - Examine the implications of legal and ethical behaviors when making financial decisions.
CAREER AWARENESS, EXPLORATION, PREPARATION, AND TRAINING
● 9.2.8.CAP.10 - Evaluate how careers have evolved regionally, nationally, and globally.
LIFE LITERACIES AND KEY SKILLS
● 9.4.5.CI.1 - Use appropriate communication technologies to collaborate with individuals with diverse perspectives about a local and/or global climate change issue and deliberate about possible solutions (e.g., W.4.6, 3.MD.B.3,7.1.NM.IPERS.6).
● 9.4.5.CI.2 - Investigate a persistent local or global issue, such as climate change, and collaborate with individuals with diverse perspectives to improve upon current actions designed to address the issue (e.g., 6.3.5.CivicsPD.3, W.5.7).
● 9.4.5.CI.3 - Participate in a brainstorming session with individuals with diverse perspectives to expand one's thinking about a topic of curiosity (e.g., 8.2.5.ED.2, 1.5.5.CR1a).
● 9.4.5.CI.4 - Research the development process of a product and identify the role of failure as a part of the creative process (e.g., W.4.7, 8.2.5.ED.6).
● 9.4.5.CT.1 - Identify and gather relevant data that will aid in the problem-solving process (e.g., 2.1.5.EH.4, 4-ESS3-1, 6.3.5.CivicsPD.2).

● 9.4.5.CT.2 - Identify a problem and list the types of individuals and resources (e.g., school, community agencies, governmental, online) that can aid in solving the problem (e.g., 2.1.5.CHSS.1, 4-ESS3-1).
● 9.4.5.CT.4 - Apply critical thinking and problem-solving strategies to different types of problems such as personal, academic, community and global (e.g., 6.1.5.CivicsCM.3).
● 9.4.5.DC.8 - Propose ways local and global communities can engage digitally to participate in and promote climate action (e.g., 6.3.5.GeoHE.1).

PRACTICES
● CLKSP1 - Act as a responsible and contributing community member and employee.
● CLKSP3 - Consider the environmental, social, and economic impacts of decisions.
● CLKSP4 - Demonstrate creativity and innovation.
● CLKSP5 - Utilize critical thinking to make sense of problems and persevere in solving them.

Interdisciplinary Connections:

English Language Arts
Reading- Informational
● RI.5.2 - Determine two or more main ideas of a text and explain how they are supported by key details; summarize the text. (5-ESS2-1)(5-ESS2-2)(5-ESS3-1)
● RI.5.4 - Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a grade 5 topic or subject area. (5-ESS2-1)(5-ESS2-2)(5-ESS3-1)
● RI.5.7 - Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (5-ESS2-1)(5-ESS2-2) (5-ESS3-1)
● RI.5.9 - Integrate and reflect on (e.g. practical knowledge, historical/cultural context, and background knowledge) information from several texts on the same topic in order to write or speak about the subject knowledgeably. (5-ESS3-1)
● RI.5.10 - By the end of the year, read and comprehend literary nonfiction at grade level text-complexity or above, with scaffolding as needed. (5-ESS2-1)(5-ESS2-2)(5-ESS3-1)
Writing
● W.5.8 - Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources. (5-ESS2-2),(5-ESS3-1)
● W.5.9 - Draw evidence from literary or informational texts to support analysis, reflection, and research. (5-ESS3-1)

Speaking and Listening

● SL.5.5 - Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes. (5-ESS2-1),(5-ESS2-2)

Math

Mathematical Practices

● MP.1 - Make sense of problems and persevere in solving them. (5-ESS2-2)
● MP.2 - Reason abstractly and quantitatively. (5-ESS2-1),(5-ESS2-2),(5-ESS3-1)
● MP.3 - Construct viable arguments and critique the reasoning of others. (5-ESS3-1)
● MP.4 - Model with mathematics. (5-ESS2-1),(5-ESS2-2),(5-ESS3-1)

Geometry

● 5.G.2 - Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation. (5-ESS2-2)

Social-Emotional Competencies

- **Self-Awareness**: ability to recognize one's emotions and know one's strengths and limitations
    - Connections:
        - Regular check-ins to share feelings (Oral, Thumbs Up, Thumbs Down, Emojis, etc.)
        - Reflecting on one's learning (Oral, Thumbs Up, Thumbs Down, Pictures, etc.)
        - Mindfulness and relationship with nature. Walk outside.
        - Reflecting on how individuals can positively impact climate change.

- **Self-Management**: ability to regulate and control one's emotions and behaviors, particularly in stressful situations
    - Connections:
        - Counting down from 20 to 1, or 10 to 1
        - Playing soft Nature Sounds music
        - GoNoodle - "Melting" Video
        - Use of cool down space in classroom

- **Social Awareness**: ability to take the perspective of others, demonstrate empathy, acknowledge and appreciate similarities and differences, and understand how one's

actions influence and are influenced by others
    - Connections:
        - Students helping each other
        - Playing games
        - Role play ways in which students can help the environment to reduce climate change (i.e. recycle, reuse, reduce, clean up neighborhood)

- **Relationship Skills**: refers to one's ability to demonstrate prosocial skills and behaviors in order to develop meaningful relationships and resolve interpersonal conflicts
    - Connections:
        - Class discussions
        - Incentives for individual students and small groups
        - Collaborate with groups to determine actions to help reduce effects of climate change

- **Responsible Decision-Making**: refers to the ability to use multiple pieces of information to make ethical and responsible decisions
    - Connections:
        - Class rules and routines
        - Class discussions
        - Following directions
        - Choices to reduce pollution and use of non-renew able resources to help reduce the effects of climate change. (reusable water bottle, only paper straws, recycle)

UNIT OBJECTIVES

Students will be able to …

- Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact. (5-ESS2-1)

  [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.]

Disciplinary Ideas

- Understand that Earth has four major systems. They are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans).

- Understand that the Earth's systems interact in multiple ways to affect Earth's surface materials and processes.
- Understand that the hydrosphere supports a variety of ecosystems and organisms, shapes landforms, and influences climate.
- Understand that the atmosphere influences landforms and weather.

Crosscutting Concepts

- Recognize that a system can be described in terms of its components and their interactions.

Science and Engineering Practices

- Develop a model using an example to describe a scientific principle.

5-ESS2-1

Concepts	Students can...
• Earth's major systems, *geosphere* (solid and molten rock, soil, and sediments), the *hydrosphere* (water and ice), the *atmosphere* (air), and the *biosphere* (living things, including humans), interact in multiple ways. • The Earth's major systems support a variety of ecosystems and organisms, shape landforms, and influence climate. • A system can be described in terms of its components and their interactions.	• Describe a system in terms of its components and interactions. • Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact. (Note: two systems at a time) Examples may include: ○ The influence of oceans on ecosystems, landform shape, and climate. ○ The influence of the atmosphere on landforms and ecosystems through weather and climate. ○ The influence of mountain ranges on the wind and clouds in the atmosphere. • Develop a model using an example to describe a scientific principle.

Students will be able to …

- Describe and graph the amounts and percentages of water and fresh water in various

reservoirs to provide evidence about the distribution of water on Earth. (5-ESS2-2)

[Assessment Boundary: Assessment is limited to oceans, lakes, rivers, glaciers, ground water, and polar ice caps, and does not include the atmosphere.]

Disciplinary Ideas

- Understand that nearly all of Earth's available water is in the ocean.
- Understand that most freshwater is in glaciers or underground; only a tiny fraction is in streams, lakes, wetlands, and the atmosphere.

Crosscutting Concepts

- Recognize that standard units are used to measure and describe physical quantities such as weight, and volume.

Science and Engineering Practices

- Describe and graph quantities such as area and volume to address scientific questions.

5-ESS2-2

Concepts	Students can...
• Nearly all of Earth's available water is in the ocean. • Most freshwater is in glaciers or underground; only a tiny fraction is in streams, lakes, wetlands, and the atmosphere. • Standard units are used to measure and describe physical quantities such as weight and volume.	• Understand the amounts and percentages of water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth. • Describe physical quantities, such as weight and volume, in standard units. • Describe and graph quantities such as area and volume to address scientific questions.

Students will be able to …

- Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment and **address climate change issues**. (5-ESS3-1)

Disciplinary Ideas

- Understand that human activities in agriculture, industry, and everyday life have

had major effects on the land, vegetation, streams, ocean, air, and even outer space; Individuals and communities are taking initiatives to help protect Earth's resources and environments to reduce the impact of climate change by developing an awareness of their carbon footprint.

Crosscutting Concepts

- Recognize that a system can be described in terms of its components and their interactions.

Science and Engineering Practices

- Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem.

5-ESS3-1

Concepts	Students can...
• Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. • Individuals and communities are doing things to help protect Earth's resources and environments and address climate change issues. • A system can be described in terms of its components and their interactions.	• Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources, environment, and address climate change issues. • Describe a system in terms of its components and interactions. • Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem.

*Updated with 2020 NJ

SUGGESTED ACTIVITIES

- NOAA What-a-Cycle: http://ngss.nsta.org/Resource.aspx?ResourceID=13

  http://www.srh.noaa.gov/jetstream/atmos/ll_whatacycle.html Through role-playing as a particle of water, students gain an understanding of the complexity of the movement of water through earth's systems. Stations are set-up for nine different water reservoirs associated with the water cycle. On each turn, students roll the dice at each station and either stay in place or

move to a different location. Students track their unique journey through the water cycle to later share and discuss the strengths and limitations of the game as a model for the movement of water through Earth's systems.

- Generation Genius DIY: Build a Dam
- STEM LAB Hydroponics Unit is a perfect way for students to be learning about Hydroponic
- Make an Air Pollution Catcher

- Develop a model: You've learned about Earth's geosphere, hydrosphere, atmosphere, and biosphere and have seen ways which these systems interact. How can you develop a model to describe an interaction between two of Earth's spheres? For example, you might show how weather and climate affect landforms, or how mountain ranges affect clouds and rain, or how the ocean affects the shape of the land. Draw diagrams, posters, 3-D models, or a computer animation. Present it to the class, include the identification of the spheres involved and describe their interactions.

- Graphing Water Data- Most of the Earth's surface is covered with water, but from which source? Water is located in five main reservoirs: ocean water; ice caps and glaciers; groundwater; surface water, such as streams and lakes; and the atmosphere in the form of water vapor. For this activity, research these five reservoirs, the volume of water they hold, and graph them on a coordinate grid in the form of a bar graph. (Reservoirs of Available Water)

- Plants and Pollution- How does polluted soil impact a plant's ability to grow?

- Global Water Distribution: http://mass.pbslearningmedia.org/resource/ess05.sci.ess.watcyc.lp_waterconservation/water-conservation/ In this lesson sequence, students predict and model the availability of water on Earth and discuss methods that can be used to purify and conserve this critical resource. They also assess how much water they and their families typically use, and think about ways to reduce their water usage. Finally, students explore different techniques being employed for water management around the world, including the use of dams to create reservoirs.

- Simulating an Oil Spill to Understand Environmental Impact: https://www.teachingchannel.org/videos/natural-resources-lesson-plan This 8 minute instructional video provides a model for teachers to follow of a week long investigation of oil

spills and the environmental impact they have on shorelines and creatures. Students take on the task of cleaning up a simulated oil spill.

- Connect the Spheres: Earth Systems Interactions | Precipitation Education Students will investigate Earth systems by making observations in nature and identifying systems in the natural world.

- Classroom Activities, categorized by the Next Generation Science Standards (NGSS) Multiple labs that correlate to the NGSS-S standards for Earth Systems

- Plants and Pollution experiment Do Plants Experience Pollution? Will Plants Grow More or Less or be Unaffected when Grown in Polluted Soil? | Science project | Education.com

- Plants and pollution activity https://blogs.longwood.edu/pollutionissues/ph-level-or-specific-pollutant/

- Reducing Your Carbon Footprint

Unit Specific Vocabulary
atmosphere: the Earth system that is made up of a mixture of gasses that is air **biosphere:** the Earth system that includes all the living things found on Earth **climate:** the general weather of a place over a long period of time, such as many years **climate change:** a significant change in the measures of climate (like temperature, precipitation, wind patterns, among other effects) lasting for an extended period of time. **fresh water:** water that is not salty (contains less than 500 parts per million (ppm) of dissolved salts) **gas:** matter that spreads to fill a space **geosphere:** the solid part of the earth consisting of the crust and outer mantle **glacier:** a very large area of ice that moves slowly down a slope, valley or wide area of land **greenhouse effect:** the trapping of some solar radiation by a planet's atmosphere, increasing the temperature on and near the surface **hydrosphere:** all the water at or near the Earth's surface, including liquid bodies of water, frozen water as ice and snow, water found underground and water found in the atmosphere. **reservoir:** a large natural or artificial lake used as a source of water supply **salt water:** water containing salt. 96.5% of all the Earth's water is contained within the oceans as salt water, while the remaining 3.5% is freshwater lakes and frozen water locked up in glaciers and the polar ice caps **system:** an organized structure for arranging or classifying **volume:** the amount of space that a substance or object occupied

Instructional Materials and Learning Activities
Core Instructional Materials: ● *National Geographic Exploring Science 5* ● *National Geographic My NG connect Exploring Science 5 Digital Resources* ● *National Geographic Exploring Science through Literacy* ● *Hand2Mind Exploring Science Hands on Kit* *Digital Resources*: ● Access the Next Generation Science Standards by Topic - The NGSS standards ● ● Classroom Resources - NGSS Hub - lesson ideas ● http://sciencespot.net/Pages/refdeskNextGen.html - lesson ideas ● http://www.studyjams.com -Study Jams ● http://www.brainpop.com- BrainPop ● https://www.generationgenius.com/ *Supplemental Materials*: ● *Delta Science* Readers ● Discovery Education: Streaming Plus & Science Tech Book

Leveled Readers:

Level Reader	Below-Level	On-Level	Above-Level
Earth's Crazy Climate	790L	930L	990L
Power Up	850L	950L	1020L

Suggested Modifications

These strategies can be adapted to scaffold for students needing more support or extending the learning for higher level students. Differentiation is accomplished through content, process, product, and learning environment.

NGSS Appendix D - "All Standards, All Students": Making the Next Generation Science Standards Accessible to All Students

Special Education Students
● Ask: How is Earth's biosphere different from the geosphere, hydrosphere, and atmosphere? (The

biosphere is made up of all living things on Earth; the other three systems are made up of nonliving things.
- Have students make a word map about ocean ecosystems. Have them write the words *Ocean Ecosystems* in a circle. Then have them draw three other circles and write in the names of the ecosystems illustrated on page 113. They can add circles to the web with details about the three ecosystems.
- Have pairs write a series of sentences that show a sequence of events that take place. The events should describe human activities and how these activities impact water and the environment. Students can use the text as a source for their sentences.
- Extended time for assignment
- Prompting
- Reassurance
- Time to formulate ideas
- Use of visual clues when reading
- Preferential seating
- Repeated directions
- Instructional Aides in the classroom setting
- Peer models
- Preview content vocabulary and schema
- Use of FM system to improve attention and support auditory information
- Behavior chart to increase focus and work completion
- Sensory breaks
- Chromebook extensions *(text-to-speech)*
- Graphic organizers

Students at Risk

- Ask: How is Earth's biosphere different from the geosphere, hydrosphere, and atmosphere? (The biosphere is made up of all living things on Earth; the other three systems are made up of nonliving things.
- Have students make a word map about ocean ecosystems. Have them write the words *Ocean Ecosystems* in a circle. Then have them draw three other circles and write in the names of the ecosystems illustrated on page 113. They can add circles to the web with details about the three ecosystems.
- Have pairs write a series of sentences that show a sequence of events that take place. The events should describe human activities and how these activities impact water, the environment, and the effect on climate change. Students can use the text as a source for their sentences.
- Response to intervention - targeted skill/goal improvement plans within a set time frame
- Multisensory manipulatives
- Preferential seating
- Behavior chart to increase focus and work completion
- Use of FM system to improve attention and support auditory information
- Sensory breaks
- Chromebook extensions *(text-to-speech)*
- Leveled texts
- Audio books

- Consultation with academic support teachers to address skills identified by the classroom teacher
- Modification of assignments and assessments
- Splitting up open ended components of assessments into manageable tasks

English Language Learners

- Help students understand the vocabulary in the lesson by writing the lesson's boldfaced words on the board. Underline the root word *sphere*. Tell students that a sphere is a ball. Then describe the meaning of the prefixes of each word.
- Provide sentence frames for students to complete: *All liquid water on Earth makes up the (hydrosphere). All solid parts of Earth make up the (geosphere). All living things on Earth make up the (biosphere). All gasses around Earth make up the (atmosphere).*
- Have students divide a sheet of paper into four sections and label each section with one of Earth's systems. Have students write as many words as possible to describe the parts of the system in each section on their papers
- Have students complete each sentence frame with a noun: *A monsoon is a (wind). A monsoon brings rain in (summer). A monsoon brings dry air in (winter).*
- Ask students to complete a word web using the term *monsoon*. Have them write nouns that are associated with a monsoon. (Possible answers: rain, wind, air, land, ocean, summer, winter, seasons)
- Provide students with a list of nouns, such as those suggested in the above activities, to describe. Ask students to compose sentences using the nouns.
- Write the words *wetland* and *groundwater* on the board. Draw a line between the two smaller words that make up the larger word. Tell students that in a compound word, knowing the meaning of the smaller words can help them figure out the meaning of the larger word.
- Write the following compound words on two separate index cards so each smaller word appears on one card: *wetland, landform, underground, groundwater.* Ask students to match pairs of cards to make compound words. Have students use the words they make in complete sentences to show word meanings
- Have students make a concept map. They can put the word *pollutants* inside a circle and write words to describe water pollutants in smaller surrounding circles: *fertilizers, waste, detergents, oil*.
- Have students make a concept map for *Humans Impact Water*. They should use phrases from the text, such as *dam streams, irrigate crops*, and *waste from homes*, to complete their maps.
- Have pairs write a series of sentences that show a sequence of events that take place. The events should describe human activities and how these activities impact water, the environment, and the effect on climate change. Students can use the text as a source for their sentences.
- Collaborate with English Language teacher.
- Preview content vocabulary *(with pictures and labels in the student's first language)*
- Visual clues (pictures)
- Repeated directions
- Check for understanding
- Ask pointed questions
- Peer models
- English language supports for parents of non English speaking students
- Use of iPad for translation between English and the student's first language
- Materials presented at lower TC levels

- Audio books
- Use of interactive English vocabulary websites *(Learning Chocolate)*
- Small flip book of content specific vocabulary with translations and pictures

Gifted and Talented

- Say: Humans grow crops and other plants. In what other ways do humans affect the plants of the biosphere? (Possible answers: Humans cut down trees to build with and clear plants from the land to construct buildings; they add fertilizers to the land to help plants grow; they add weed killers to prevent certain plants from growing.
- Invite students to draw a picture of an organism that is adapted to live in one the of three ecosystems described. For example, they could draw a picture of a fish that has special body parts that enable it to live in deep ocean water.
- Encourage students to create a vertical garden using hydroponics.
- Challenge questions and higher level thinking while reading both fiction and nonfiction texts
- Higher TC level texts
- Advanced STEAM activities
- Assigned leadership roles within class

Students with 504 Plans

- Ask: How is Earth's biosphere different from the geosphere, hydrosphere, and atmosphere? (The biosphere is made up of all living things on Earth; the other three systems are made up of nonliving things.
- Have students make a word map about ocean ecosystems. Have them write the words *Ocean Ecosystems* in a circle. Then have them draw three other circles and write in the names of the ecosystems illustrated on page 113. They can add circles to the web with details about the three ecosystems.
- Have pairs write a series of sentences that show a sequence of events that take place. The events should describe human activities and how these activities impact water, the environment, and the effect on climate change. Students can use the text as a source for their sentences.
- Extended time for assignment
- Prompting
- Reassurance
- Time to formulate ideas
- Use of visual clues when reading
- Preferential seating
- Repeated directions
- Instructional Aides in the classroom setting
- Peer models
- Preview content vocabulary and schema
- Use of FM system to improve attention and support auditory information
- Behavior chart to increase focus and work completion
- Sensory breaks
- Chromebook extensions *(text-to-speech)*
- Graphic organizers

Grade 5 Science Curriculum

Unit 3 : Earth & Space Science - Space Systems: Stars and the Solar System

Unit Overview

Excerpt from model curriculum- Grade 5, Unit 6, "What it looks like in the classroom"

In this unit of study, students explore the effects of gravity and determine the effect that relative distance has on the apparent brightness of stars. They also collect and analyze data in order to describe patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.

To begin the progression of learning in this unit, students explore the effects of gravity by holding up and releasing a variety of objects from a variety of heights and locations. Students should record and use their observations to describe the interaction that occurs between each object and the Earth. In addition, students should use their observations as evidence to support an argument that the gravitational force exerted by the Earth on objects is directed "down" (towards the center of the Earth), no matter the height or location from which an object is released.

Next, students investigate the effect of distance on the apparent brightness of stars. Using information from a variety of print or digital sources, students learn that natural objects vary in size, from very small to immensely large. Stars, which vary in size, also range greatly in their distance from the Earth. The sun, which is also a star, is much, much closer to the Earth than any other star in the universe. Once students understand these concepts, they should explore the effect of distance on the apparent brightness of the sun in relation to other stars. This can be accomplished by modeling the effect using a light source, such as a bright flashlight. As students vary the distance of the light from their eyes, they should notice that the farther away the light is, the less bright it appears. Observations should again be recorded and used as evidence to support the argument that the differences in the apparent brightness of the sun compared to that of other stars is due to their relative distances from the Earth.

To continue the progression of learning, students investigate the following observable patterns of change that occur due to the position and motion of the Earth, sun, moon, and stars.

- **Day and night:** This pattern of change is a daily, cyclical pattern that occurs due to the rotation of the Earth every 24 hours. Students can observe model simulations using online or digital resources, or they can create models in class of the day/night pattern caused by the daily rotation of the Earth.
- **The length and direction of shadows:** These two interrelated patterns of change are daily, cyclical patterns that can be observed and described through direct observation. Students need the opportunity to observe a stationary object at chosen intervals throughout the day

and across a few days. They should measure and record the length of the shadow and record the direction of the shadow (using drawings and cardinal directions), then use the data to describe the patterns observed.

- **The position of the sun in the daytime sky:** This daily, cyclical pattern of change can also be directly observed. Students will need the opportunity to make and record observations of the position of the sun in the sky at chosen intervals throughout the day and across a few days. Data should then be analyzed in order to describe the pattern observed.
- **The appearance of the moon in the night sky:** This cyclical pattern of change repeats approximately every 28 days. Students can use media and online resources to find data that can be displayed graphically (pictures in a calendar, for example), which will allow them to describe the pattern of change that occurs in the appearance of the moon every four weeks.
- **The position of the moon in the night sky:** This daily, cyclical pattern of change can be directly observed, but students would have to make observations of the position of the moon in the sky at chosen intervals throughout the night, which is not recommended. Instead, students can use media and online resources to learn that the moon, like the sun, appears to rise in the eastern sky and set in the western sky every night.
- **The position of the stars in the night sky:** Because the position of the stars changes across the seasons, students will need to use media and online resources to learn about this pattern of change.

Whether students gather information and data from direct observations or from media and online sources, they should organize all data in graphical displays so that the data can be used to describe the patterns of change.

Big Idea/Common Thread:

- The sun's motion in the sky causes patterns that are observable and quantifiable. These patterns of daily changes occur as the length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.

Enduring Understanding:

- The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center.
- Stars range greatly in size and distance from Earth and this can explain their relative brightness.
- The Earth's orbit and rotation, and the orbit of the moon around the Earth cause observable patterns.

Essential Questions:

- How do lengths and directions of shadows or relative lengths of day and night change from day to day?
- How does the appearance of some stars change in different seasons?

Assessments

Possible Ongoing Formative Assessments
● Wrap It Up! Questions ● Various levels of questioning ● Teacher Observation ● Student Participation ● Class Discussions/Partner Talk ● Science Notebook activities ● Performance Expectation Activities: *Investigate; Think Like a Scientist; Think Like an Engineer, STEAM Projects* ● Teacher Rubrics for Performance Expectations Activities ● Hands-on labs
Summative Assessments
● Earth Systems Science Unit Assessment (Space Systems)
Alternative Assessments
● Modified Earth Systems Science Unit Assessment (Less answer choices, highlighted vocabulary, etc.)

Standards (NJSLS) Addressed in this Unit

Disciplinary Core Ideas
○ **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) ● **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)
- **Cause and Effect**
  - Cause and effect relationships are routinely identified and used to explain change. (5-PS2-1)
- **Scale, Proportion, and Quantity**
  - Natural objects exist from the very small to the immensely large. (5-ESS1- 1)

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- PS2-1),(5-ESS1-1)

Computer Science and Design Thinking

8.1.5.DA.2: Compare the amount of storage space required for different types of data
8.1.5.DA.3: Organize and present collected data visually to communicate insights gained from different views of the data.
8.1.5.DA.5: Propose cause and effect relationships, predict outcomes, or communicate ideas using data.
8.2.5.ITH.2: Evaluate how well a new tool has met its intended purpose and identify any shortcomings it might have
8.2.5.ED.1: Explain the functions of a system and its subsystems.
8.2.5.ED.2: Collaborate with peers to collect information, brainstorm to solve a problem, and evaluate all possible solutions to provide the best results with supporting sketches or models.
8.2.5.ED.3: Follow step by step directions to assemble a product or solve a problem, using appropriate tools to accomplish the task.
8.2.5.NT.2: Identify new technologies resulting from the demands, values, and interests of individuals, businesses, industries, and societies.
8.2.5.NT.4: Identify how improvement in the understanding of materials science impacts

technologies.
8.2.5.ETW.1: Describe how resources such as material, energy, information, time, tools, people, and capital are used in products or systems.
8.2.5.ETW.2: Describe ways that various technologies are used to reduce improper use of resources.
8.2.5.ETW.3: Explain why human-designed systems, products, and environments need to be constantly monitored, maintained, and improved.
8.2.5.ETW.4: Explain the impact that resources, such as energy and materials used to develop technology, have on the environment.
8.2.5.ETW.5: Identify the impact of a specific technology on the environment and determine what can be done to increase positive effects and to reduce any negative effects, such as climate change.

Career Readiness, Life Literacies, and Key Skills

CAREER AWARENESS, EXPLORATION, PREPARATION, AND TRAINING
● 9.2.8.CAP.10 - Evaluate how careers have evolved regionally, nationally, and globally.
LIFE LITERACIES AND KEY SKILLS
● 9.4.5.CI.1 - Use appropriate communication technologies to collaborate with individuals with diverse perspectives about a local and/or global climate change issue and deliberate about possible solutions (e.g., W.4.6, 3.MD.B.3,7.1.NM.IPERS.6).
● 9.4.5.CI.2 - Investigate a persistent local or global issue, such as climate change, and collaborate with individuals with diverse perspectives to improve upon current actions designed to address the issue (e.g., 6.3.5.CivicsPD.3, W.5.7).
● 9.4.5.CI.3 - Participate in a brainstorming session with individuals with diverse perspectives to expand one's thinking about a topic of curiosity (e.g., 8.2.5.ED.2, 1.5.5.CR1a).
● 9.4.5.CI.4 - Research the development process of a product and identify the role of failure as a part of the creative process (e.g., W.4.7, 8.2.5.ED.6).
● 9.4.5.CT.1 - Identify and gather relevant data that will aid in the problem-solving process (e.g., 2.1.5.EH.4, 4-ESS3-1, 6.3.5.CivicsPD.2).
● 9.4.5.CT.2 - Identify a problem and list the types of individuals and resources (e.g., school, community agencies, governmental, online) that can aid in solving the problem (e.g., 2.1.5.CHSS.1, 4-ESS3-1).
● 9.4.5.CT.4 - Apply critical thinking and problem-solving strategies to different types of problems such as personal, academic, community and global (e.g., 6.1.5.CivicsCM.3).
● 9.4.5.DC.8 - Propose ways local and global communities can engage digitally to participate in and promote climate action (e.g., 6.3.5.GeoHE.1).

PRACTICES
● CLKSP1 - Act as a responsible and contributing community member and employee.

● CLKSP3 - Consider the environmental, social, and economic impacts of decisions.
● CLKSP4 - Demonstrate creativity and innovation.
● CLKSP5 - Utilize critical thinking to make sense of problems and persevere in solving them.

Interdisciplinary Connections:

English Language Arts

Reading - Informational

● RI.5.1 - Quote accurately from a text and make relevant connections when explaining what the text says explicitly and when drawing inferences from the text. (5-PS2-1),(5-ESS1-1)
● RI.5.7 - Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (5-ESS1-1)
● RI.5.8 - Explain how an author uses reasons and evidence to support particular points in a text, identifying which reasons and evidence support which point(s). (5-ESS1-1)
● RI.5.9 - Integrate and reflect on (e.g. practical knowledge, historical/cultural context, and background knowledge) information from several texts on the same topic in order to write or speak about the subject knowledgeably. (5-PS2-1),(5-ESS1-1)

Writing

● W.5.1- Write opinion pieces on topics or texts, supporting a point of view with reasons and information. (5-PS2-1),(5-ESS1-1)

Speaking and Listening

● SL.5.5 - Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes. (5-ESS1-2)

Math

Mathematical Practices

● MP.2 - Reason abstractly and quantitatively. (5-ESS1-1),(5-ESS1-2)
● MP.4 - Model with mathematics. (5-ESS1-1),(5-ESS1-2)

Numbers & Operations in Base Ten

● 5.NBT.A.2 - Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10. (5-ESS1-1)

Geometry

● 5.G.A.2 - Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate

values of points in the context of the situation. (5-ESS1-2)

Social-Emotional Competencies

- **Self-Awareness**: ability to recognize one's emotions and know one's strengths and limitations
    - Connections:
        - Regular check-ins to share feelings (Oral, Thumbs Up, Thumbs Down, Emojis, etc.)
        - Reflecting on one's learning (Oral, Thumbs Up, Thumbs Down, Pictures, etc.)
        - Mindfulness and relationship with nature. Walk outside.

- **Self-Management**: ability to regulate and control one's emotions and behaviors, particularly in stressful situations
    - Connections:
        - Counting down from 20 to 1, or 10 to 1
        - Playing soft Nature Sounds music
        - GoNoodle - "Melting" Video
        - Use of cool down space in classroom

- **Social Awareness**: ability to take the perspective of others, demonstrate empathy, acknowledge and appreciate similarities and differences, and understand how one's actions influence and are influenced by others
    - Connections:
        - Students helping each other
        - Playing games

- **Relationship Skills**: refers to one's ability to demonstrate prosocial skills and behaviors in order to develop meaningful relationships and resolve interpersonal conflicts
    - Connections:
        - Class discussions
        - Incentives for individual students and small groups

- **Responsible Decision-Making**: refers to the ability to use multiple pieces of information to make ethical and responsible decisions
    - Connections:
        - Class rules and routines

- Class discussions
- Following directions

UNIT OBJECTIVES

Students will be able to …

- Support an argument that the gravitational force exerted by Earth on objects is directed down. (5-PS2-1)

  [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.]

Disciplinary Ideas

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

Crosscutting Concepts

- Recognize that cause and effect relationships are routinely identified and used to explain change.

Science and Engineering Practices

- Develop an argument with evidence, data, or a model.

5-PS2-1

Concepts	Students can...
• The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center. • Cause-and-effect relationships are routinely identified and used to explain change.	• Understand that the gravitational force exerted by Earth on objects is directed down. ("Down" is a local description of the direction that points toward the center of the spherical Earth.) • Identify cause-and-effect relationships in order to explain change. • Support an argument with evidence, data, or a model.

Students will be able to …

- Support an argument that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from Earth. (5-ESS1-1)

  [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).]

Disciplinary Ideas
- Understand 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.

Crosscutting Concepts
- Recognize natural objects exist from the very small to the immensely large.

Science and Engineering Practices
- Develop an argument with evidence, data, or a model.

5-ESS1-1

Concepts	Students can...
• 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. • Natural objects exist from the very small to the immensely large.	• Understand that differences in the apparent brightness of the sun compared to that of other stars is due to their relative distances from Earth. • Support an argument with evidence, data, or a model.

Students will be able to …

- 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. (5-ESS1-2)
  [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.]

Disciplinary Ideas
- Understand that the orbits of Earth around the sun, and of the moon around Earth, together with the rotation of Earth on its axis between its North and South poles, cause observable patterns.
- These patterns include:
  - day and night
  - daily changes in the length and direction of shadows
  - different positions of the sun, moon, and stars at different times of the day, month, and year.

Crosscutting Concepts
- Recognize the similarities and differences in patterns can be used to sort, classify, communicate and analyze change for natural phenomena.

Science and Engineering Practices

- Represent data in graphical displays (line graphs or line plots) to reveal patterns that indicate relationships.

5-ESS1-2

Concepts	Students can...

• The orbits of Earth around the sun and of the moon around Earth, together with the rotation of Earth on its axis between its north and south poles, cause observable patterns. These include:
  ○ Day and night
  ○ Daily changes in the length and direction of shadows
  ○ Different positions of the sun, moon, and stars at different times of the day, month, and year.
• Similarities and differences in patterns can be used to sort, classify, communicate, and analyze change.
	• Identify patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.
	• Sort, classify, communicate, and analyze simple rates of change.
	• Represent data in graphical displays (line plots and line graphs) to reveal patterns that indicate relationships.

SUGGESTED ACTIVITIES

- Non-fiction reading about Galileo's famous gravity drop experiment.
- GRAVITY
- Gravity-EGG Drop Experiment https://www.scienceworld.ca/resource/egg-drop/
- Day and night interactive picture, click anywhere on the picture and you will see how different continents experience day and night. http://www.fourmilab.ch/cgi-bin/Earth?imgsize=1024&opt=-l&lat=28.0417&ns=North&lon=-116.083&ew=West&alt=149249513&img=learth.evif&date=0
- An experiment with shadows on a wall and a flashlight http://www.primaryresources.co.uk/science/pdfs/KSlight5a.pdf
- https://www.generationgenius.com/activities/earths-orbit-and-rotation-activity-for-kids/

- Experiment with the sun and other students casting and analyzing shadows https://stardate.org/sites/default/files/pdfs/teachers/ShadowPlay.pdf
- Simple science experiment, gravity water drop http://www.metrofamilymagazine.com/July-2014/Simple-Science-Experiments-Gravity-Water-Drop/
- DIY constellation projector DIY Constellation Projector
- Making Shadows - A STEM lab where students create a model of the Sun and how it creates different shadows based around its movement

Unit Specific Vocabulary

absolute brightness: an object's absolute brightness is how bright the object actually is, not its apparent brightness, which can be impacted by distance from the object.
apparent brightness: an object's apparent brightness is how bright it appears in the sky, not its actual or absolute brightness, which can be impacted by distance from the object.
apparent motion: motion that seems to happen.
axis: an imaginary line about which a body rotates
constellation: a pattern of stars, which are man made.
gravity: a force that pulls one object towards another object of greater mass.
line plot: a line plot is a graph that shows frequency of data along a number line.
line graph: a useful for displaying data or information that changes continuously over time.
orbit: the path a revolving body follows.
revolution: the motion of one object around another.
rotate: spin around.
star: a ball of hot gas that gives off light and other types of energy that range greatly in size and energy.

Instructional Materials and Learning Activities

Core Instructional Materials:

- *National Geographic Exploring Science 5*
- *National Geographic My NG connect Exploring Science 5 Digital Resources*
- *National Geographic Exploring Science through Literacy*
- *Hand2Mind Exploring Science Hands on Kit*

Digital Resources:

- Access the Next Generation Science Standards by Topic - The NGSS standards
- http://stars.chromeexperiments.com/ - star animation

- http://www.skymaponline.net/ - star map, which shows magnitude and distance
- http://ngss.nsta.org/Classroom-Resources.aspx - lesson ideas
- http://sciencespot.net/Pages/refdeskNextGen.html - lesson ideas
- https://www.generationgenius.com/

Supplemental Materials:

- *Delta Science* Readers
- Discovery Education: Streaming Plus & Science Tech Book

Leveled Readers:

Level Reader	Below-Level	On-Level	Above-Level
The Sinking of the Titanic	860L	940L	1010L
The World's Ocean	780L	910L	1000L

Suggested Modifications

These strategies can be adapted to scaffold for students needing more support or extending the learning for higher level students. Differentiation is accomplished through content, process, product, and learning environment.

NGSS Appendix D - "All Students, All Students": Making the Next Generation Science Standards Accessible to All Students

Special Education Students

- Write the following careers on the board: *biologist, chemist, astronomer,* and *physicist*. Have pairs of students use a dictionary to look up the word meanings and write a sentence describing the work of each one.
- Challenge pairs of students to make a crossword puzzle of careers mentioned in the lesson: *astrobiologist, biologist, chemist, physicist, engineer*. Students may use a dictionary to find definitions for each.
- Have students complete simple sentence frames to explain their understanding of stars and the solar system.
- Extended time for assignment
- Prompting
- Reassurance
- Time to formulate ideas
- Use of visual clues when reading
- Preferential seating

- Repeated directions
- Instructional Aides in the classroom setting
- Peer models
- Preview content vocabulary and schema
- Use of FM system to improve attention and support auditory information
- Behavior chart to increase focus and work completion
- Sensory breaks
- Chromebook extensions *(text-to-speech)*
- Graphic organizers

Students at Risk

- Write the following careers on the board: *biologist, chemist, astronomer,* and *physicist*. Have pairs of students use a dictionary to look up the word meanings and write a sentence describing the work of each one.
- Have students complete simple sentence frames to explain their understanding of stars and the solar system.
- Response to intervention - targeted skill/goal improvement plans within a set time frame
- Multisensory manipulatives
- Preferential seating
- Behavior chart to increase focus and work completion
- Use of FM system to improve attention and support auditory information
- Sensory breaks
- Chromebook extensions *(text-to-speech)*
- Leveled texts
- Audio books
- Consultation with academic support teachers to address skills identified by the classroom teacher
- Modification of assignments and assessments
- Splitting up open ended components of assessments into manageable tasks

English Language Learners

- Have students complete simple sentence frames such as: *Brendan Mullan is an (astrobiologist). Sharing scientific ideas with other people is (scientific communication).*
- Invite students to skim the lesson and make a word web of action verbs they find, for example: *studies, survive, work, won, present*. Encourage students to draw pictures to show the action of the verbs.
- Challenge pairs of students to make a crossword puzzle of careers mentioned in the lesson: *astrobiologist, biologist, chemist, physicist, engineer*. Students may use a dictionary to find definitions for each.
- Collaborate with English Language teacher.
- Preview content vocabulary *(with pictures and labels in the student's first language)*
- Visual clues (pictures)
- Repeated directions
- Check for understanding
- Ask pointed questions
- Peer models

- English language supports for parents of non English speaking students
- Use of iPad for translation between English and the student's first language
- Materials presented at lower TC levels
- Audio books
- Use of interactive English vocabulary websites *(Learning Chocolate)*
- Small flip book of content specific vocabulary with translations and pictures

Gifted and Talented

- Ask students to imagine they are working with Brendan Muller as an assistant. Say: You think you may have found a planet where intelligent life exists. Write a letter that explains what you would like these intelligent life forms to know about people who live on planet Earth and why you would like to meet them.
- Challenge questions and higher level thinking while reading both fiction and nonfiction texts
- Higher TC level texts
- Advanced STEAM activities
- Assigned leadership roles within class

Students with 504 Plans

- Write the following careers on the board: *biologist, chemist, astronomer, and physicist.* Have pairs of students use a dictionary to look up the word meanings and write a sentence describing the work of each one.
- Have students complete simple sentence frames to explain their understanding of stars and the solar system.
- Extended time for assignment
- Prompting
- Reassurance
- Time to formulate ideas
- Use of visual clues when reading
- Preferential seating
- Repeated directions
- Instructional Aides in the classroom setting
- Peer models
- Preview content vocabulary and schema
- Use of FM system to improve attention and support auditory information
- Behavior chart to increase focus and work completion
- Sensory breaks
- Chromebook extensions *(text-to-speech)*
- Graphic organizers

Grade 5 Science Curriculum

Unit 4: Physical Science - Structure and Properties of Matter

Unit Overview

Excerpt from model curriculum, Grade 5, Units 1 and 2,"Unit Summary"

In this unit of study, students describe that matter is made of particles too small to be seen by developing a model. The crosscutting concept of scale, proportion, and quantity is called out as an organizing concept for these disciplinary core ideas. Students demonstrate grade-appropriate

proficiency in developing and using models, planning and carrying out investigations, and use these practices to demonstrate understanding of the core ideas. (NJ State, Unit 1)

In this unit of study, students 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. (NJ State, Unit 2)

Excerpt from model curriculum, Grade 5, Units 1 and 2- "What it looks like in the classroom"

The concepts and practices in this unit are foundational for understanding the relationship between changes to matter and its weight. During this unit of study, students will observe, measure, and identify materials based on their properties and begin to get a conceptual understanding of the particle nature of matter (i.e., all matter is made of particles too small to be seen).

In the first portion of the unit, students will focus on measuring and describing a variety of physical properties, including color, hardness, reflectivity, electrical conductivity, thermal conductivity, response to magnetic forces and solubility. These observations and measurements are used to produce data that serves as the basis for evidence that can be used to identify materials. Students need opportunities to observe, measure, and describe a variety of types of matter, such as baking soda and other powders; metals; minerals; and liquids. Standard units should be used to measure the properties of weight, time, temperature, and volume; however, at this grade level, mass and weight are not distinguished. In addition, students are not expected to understand density as a physical property, and no attempt should be made to define unseen particles or explain the atomic-scale mechanism of evaporation and condensation.

In the second portion of the unit, students make observations, gather evidence, and develop models in order to understand that matter is made up of particles too small to be seen. Matter of any type can be subdivided into small particles. In planning and carrying out simple investigations, students will produce data to be used as evidence to support the idea that even though matter is made of particles too small to be seen, matter can still exist and can be detected by means other than seeing. This evidence will be used to support students' thinking as they develop models that depict matter. For example, a model that represents solids at the particle level would show particles tightly packed, while a model that represents gases would show particles moving freely around in space. Observing such phenomena as adding air to expand a basketball, compressing

air in a syringe, dissolving sugar in water, or evaporating salt water could help students to understand matter at the particle level and to build models that represent this phenomenon.

Although engineering design is not explicitly called out in this unit, students could incorporate engineering design in a number of ways as they explore the particle nature of matter. Students can design ways/tools to measure a given physical property, such as hardness, reflectivity, electrical or thermal conductivity, or response to magnetic forces. The engineering design process can be used to analyze students' models using criteria. Then students can improve their designs based on analysis. (NJ State Model Curriculum, Unit 1)

In this unit of study, students will use mathematical and computational thinking to understand the cause and effect relationship between physical changes in matter and conservation of weight. Throughout the unit, students need multiple opportunities to observe and document changes in matter due to physical changes, and to analyze data to explain changes that do or do not occur in the physical properties of matter. Students begin by planning and conducting investigations to determine whether or not a new substance is made when two or more substances are mixed.

As they work with a variety of substances, they should:

- Measure, observe, and document physical properties (e.g., color, mass, volume, size, shape, hardness, reflectivity, conductivity, and response to magnetic forces) of two or three substances.
- Mix the original substances.
- Measure, observe, and document the physical properties of the substance produced when the original substances are mixed.
- Compare data from the original substances to data from the substance produced, and determine what changes, if any, have occurred.
- Use observations and data as evidence to explain whether or not a new substance was produced, and to explain any changes that occurred when the original substances were mixed.

With each set of substances that students investigate, it is important that they use balances to measure the mass of the original substances and the mass of the substance made when the original substances are mixed. These data should be documented so that students can analyze the data. As they compare the data, they should recognize that when two or more substances are mixed, the mass of the resulting substance equals the sum of the masses of the original substances. In other words, the total mass is conserved.

Conservation of mass is a critical concept that is developed over time; therefore, students need multiple opportunities to investigate this phenomenon. Students should measure the mass of each substance, document the data they collect in a table or chart, and use the data as evidence that regardless of the changes that occur when mixing substances, the total weight of matter is conserved.

In addition to observing changes that occur when substances are mixed, students should also have opportunities to investigate other types of physical changes. For example, students can observe changes in matter due to heating, cooling, melting, freezing, and/or dissolving. As before, students should measure, observe, and document the physical properties of the substance before and after a physical change, and use the data as evidence to explain any changes that occur. The data should also provide evidence that regardless of the type of change that matter undergoes, the mass is conserved. (NJ State Model Curriculum, Unit 2)

Big Idea/Common Thread:

- Matter is made of particles too small to be seen. Regardless of the type of change that matter undergoes, the total weight of matter is conserved. The mixing of two or more substances results in new substances.

Enduring Understanding:

- Matter exists as particles that are too small to see, and is always conserved, even if it seems to disappear.
- Measurements of a variety of observable properties can be used to identify particular materials.
- Chemical reactions that occur when substances are mixed can be identified by the emergence of substances with different properties; the total weight remains the same.

Essential Questions:

- How can matter change?
- How can properties be used to identify materials?
- What kind of model would best represent/describe matter as made of particles that are too small to be seen?

Assessments

Possible Ongoing Formative Assessments
• Wrap It Up! Questions • Various levels of questioning

- Teacher Observation
- Student Participation
- Class Discussions/Partner Talk
- Science Notebook activities
- Performance Expectation Activities: *Investigate; Think Like a Scientist; Think Like an Engineer, STEAM Projects*
- Teacher Rubrics for Performance Expectations Activities
- Hands-on labs

Summative Assessments

- Physical Science Unit Assessment

Alternative Assessments

- Modified Physical Science Unit Assessment (Less answer choices, highlighted vocabulary, etc.)

Standards (NJSLS) Addressed in this Unit

Disciplinary Core Ideas

- **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 gases 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**
  - 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)

Science and Engineering Practices

- **Developing and Using Models**
  - Develop a model to describe phenomena. (5-PS1-1)

- **Planning and Carrying Out Investigations**
  - 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**
  - Measure and graph quantities such as weight to address scientific and engineering questions and problems. (5-PS1-2)

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)

Computer Science and Design Thinking

8.1.5.IC.2: Identify possible ways to improve the accessibility and usability of computing technologies to address the diverse needs and wants of users.
8.1.5.DA.1: Collect, organize, and display data in order to highlight relationships or support a claim.
8.1.5.DA.3: Organize and present collected data visually to communicate insights gained from different views of the data.
8.1.5.DA.5: Propose cause and effect relationships, predict outcomes, or communicate ideas using data.

Career Readiness, Life Literacies, and Key Skills

CAREER AWARENESS, EXPLORATION, PREPARATION, AND TRAINING

● 9.2.8.CAP.10 - Evaluate how careers have evolved regionally, nationally, and globally.

LIFE LITERACIES AND KEY SKILLS

● 9.4.5.CI.1 - Use appropriate communication technologies to collaborate with individuals with diverse perspectives about a local and/or global climate change issue and deliberate about possible solutions (e.g., W.4.6, 3.MD.B.3,7.1.NM.IPERS.6).

● 9.4.5.CI.2 - Investigate a persistent local or global issue, such as climate change, and collaborate with individuals with diverse perspectives to improve upon current actions designed to address the issue (e.g., 6.3.5.CivicsPD.3, W.5.7).

● 9.4.5.CI.3 - Participate in a brainstorming session with individuals with diverse perspectives to expand one's thinking about a topic of curiosity (e.g., 8.2.5.ED.2, 1.5.5.CR1a).

● 9.4.5.CI.4 - Research the development process of a product and identify the role of failure as a part of the creative process (e.g., W.4.7, 8.2.5.ED.6).

● 9.4.5.CT.1 - Identify and gather relevant data that will aid in the problem-solving process (e.g., 2.1.5.EH.4, 4-ESS3-1, 6.3.5.CivicsPD.2).

● 9.4.5.CT.2 - Identify a problem and list the types of individuals and resources (e.g., school, community agencies, governmental, online) that can aid in solving the problem (e.g., 2.1.5.CHSS.1, 4-ESS3-1).

● 9.4.5.CT.4 - Apply critical thinking and problem-solving strategies to different types of problems such as personal, academic, community and global (e.g., 6.1.5.CivicsCM.3).

● 9.4.5.DC.8 - Propose ways local and global communities can engage digitally to participate in and promote climate action (e.g., 6.3.5.GeoHE.1).

PRACTICES

● CLKSP1 - Act as a responsible and contributing community member and employee.

● CLKSP4 - Demonstrate creativity and innovation.

● CLKSP5 - Utilize critical thinking to make sense of problems and persevere in solving them.

Interdisciplinary Connections:

English Language Arts

<u>Reading- Informational</u>

● RI.5.7 - Draw on information from multiple print or digital sources,demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (5-PS1- 1)

<u>Writing</u>

● W.5.8 - Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources. (5-PS1-2),(5-PS1-3),(5-PS1-4)

● W.5.9 - Draw evidence from literary or informational texts to support analysis, reflection, and research. (5-PS1-2),(5-PS1-3),(5-PS1-4)

Speaking and Listening
● SL.5.5 - Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes. (5-PS3-1),(5-LS2-1)

Mathematics

Mathematical Practices
● MP.2 - Reason abstractly and quantitatively. (5-PS1-1),(5-PS1-2),(5-PS1-3)
● MP.4 - Model with mathematics. (5-PS1-1),(5-PS1-2),(5-PS1-3)
● MP.5 - Use appropriate tools strategically. (5-PS1-2),(5-PS1-3)

Numbers & Operations in Base Ten
● 5.NBT.A.1 - Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10. (5-PS1-1)

Numbers & Operations in Base Ten-Fractions
● 5.NF.B.7 - Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions.
(5-PS1-1)

Measurement & Data
● 5.MD.A.1 - Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real-world problems. (5-PS1-2)
● 5.MD.C.3 - Recognize volume as an attribute of solid figures and understand concepts of volume measurement. (5-PS1-1)
● 5.MD.C.4 - Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units. (5-PS1-1)

Social-Emotional Competencies

- **Self-Awareness**: ability to recognize one's emotions and know one's strengths and limitations
    - Connections:
        - Regular check-ins to share feelings (Oral, Thumbs Up, Thumbs Down, Emojis, etc.)

        - Reflecting on one's learning (Oral, Thumbs Up, Thumbs Down, Pictures, etc.)
        - Mindfulness and relationship with nature. Walk outside.

- **Self-Management**: ability to regulate and control one's emotions and behaviors, particularly in stressful situations
    - Connections:
        - Counting down from 20 to 1, or 10 to 1
        - Playing soft Nature Sounds music
        - GoNoodle - "Melting" Video
        - Use of cool down space in classroom

- **Social Awareness**: ability to take the perspective of others, demonstrate empathy, acknowledge and appreciate similarities and differences, and understand how one's actions influence and are influenced by others
    - Connections:
        - Students helping each other
        - Playing games

- **Relationship Skills**: refers to one's ability to demonstrate prosocial skills and behaviors in order to develop meaningful relationships and resolve interpersonal conflicts
    - Connections:
        - Class discussions
        - Incentives for individual students and small groups

- **Responsible Decision-Making**: refers to the ability to use multiple pieces of information to make ethical and responsible decisions
    - Connections:
        - Class rules and routines
        - Class discussions
        - Following directions

UNIT OBJECTIVES

Students will be able to …

- Develop a model to describe that matter is made of particles too small to be seen. (5-PS1-1)

    [Clarification Statement: Examples of evidence 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.]

Disciplinary Ideas

- Understand that 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. (5-PS1-1)

Crosscutting Concepts

- Recognize that natural objects exist from the very small to the immensely large. (5-PS1-1)

Science and Engineering Practices

- Develop a model to describe phenomena. (5-PS1-1).

5-PS1-1

Concepts	Students can...
• 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 means other than seeing. • Natural objects exist from the very small to the immensely large. • A model showing that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations.	• Understand that matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists • Develop a model to describe that matter is made of particles too small to be seen. Examples of evidence could include: • Adding air to expand a basketball • Adding air to expand a balloon • Compressing air in a syringe • Dissolving sugar in water • Evaporating salt water

Students will be able to …

- **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.** (5-PS1-2)
  [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.]

Disciplinary Ideas

- Understand that the amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish.
- No matter what reaction or change in properties occurs, the total weight of the substances does not change.

Crosscutting Concepts

- Recognize that standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume.

Science and Engineering Practices

- Measure and graph quantities such as weight to address scientific and engineering questions and problems.

5-PS1-2

Concepts	Students can...
• The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish. • No matter what reaction or change in properties occurs, the total weight of the substances does not change. • Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume.	• Provide evidence that regardless of the type of change that occurs when substances are heated, cooled, or mixed, the total weight is conserved. Examples of reactions or changes could include: ◦ Phase changes (condensing, melting, freezing) ◦ Dissolving ◦ Mixing • Measure and describe physical quantities such as weight, time, temperature, and volume.

Students will be able to …

- Make observations and measurements to identify materials based on their properties.(5-PS1-3)

  [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.]

Disciplinary Ideas

- Understand that measurements of a variety of properties can be used to identify materials.

Crosscutting Concepts

- Recognize that standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume.

Science and Engineering Practices

- Make observations and measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon.

5-PS1-3

Concepts	Students can...
• Measurements of a variety of properties can be used to identify materials. • Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume.	• Identify materials based on their properties. Examples of materials to be identified could include: ◦ Baking soda or other powders ◦ Metals ◦ Minerals ◦ Liquids Examples of properties could include: ◦ Color ◦ Hardness ◦ Reflectivity ◦ Electrical conductivity ◦ Thermal conductivity ◦ Response to magnetic forces ◦ Solubility • Measure and describe physical quantities such as weight, time, temperature, and volume. • Make observations and measurements to serve as evidence for an explanation.

Students will be able to …

- Conduct an investigation to determine whether the mixing of two or more substances results in new substances. (5-PS1-4)

Disciplinary Ideas

- Understand that when two or more different substances are mixed, a new substance with different properties may be formed.

Crosscutting Concepts

- Recognize that cause and effect relationships are routinely identified, tested, and used to explain change.

Science and Engineering Practices

- 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

Concepts	Students can...
• When two or more different substances are mixed, a new substance with different properties may be formed. • Cause-and-effect relationships are used to explain change.	• Conduct an investigation to determine whether the mixing of two or more substances results in new substances. • Explain change through cause-and-effect relationships. • Conduct an investigation with controlled variables, to gather data.

SUGGESTED ACTIVITIES

- What happens to weight and volume when water freezes A simple experiment for students to see once frozen how water changes weight.

- How to Make Slime - At-Home Slime Experiment How can we make slime? This shows students how combining substances changes the substance itself.

- What kind of model would best represent/describe matter as made of particles that are too small to be seen?

- Time to Teach: Properties of Matter — The Science Penguin In this unit, students will be introduced to the different states of matter by completing small experiments on each property.

- https://www.teacherspayteachers.com/FreeDownload/Properties-of-Matter-Chart-Sorting-Activity Properties of Matter chart and sorting activity.

- How to Make Rock Candy

- The Incredible Shrinking Egg

- https://www.exploratorium.edu/science_explorer/bubblebomb.html Make a bubble bomb out of zip loc bag and baking soda, careful, this one could be messy.
- https://tinyurl.com/l7gg9qx - a delicious physical lab involving changing cream into different states of matter. The end result is butter!

- https://tinyurl.com/m9zjvcg - create hot yellow gas in this chemical reaction lab

- https://www.scientificamerican.com/article/make-elephant-toothpaste/ -- create “elephant toothpaste” in this explosive chemical reaction lab

Unit Specific Vocabulary
chemical change: the change of a material into an entirely different material with properties that are different from the original material. **chemical reaction**: the process by which a chemical change occurs. **conservation of matter:** matter can never be destroyed. During any change, matter is conserved. **condensation**: the change from a gas to a liquid. **electrical conductivity:** how well a substance allows electric current to pass through it. **evaporation**: the change of state from a liquid into a gas. **magnetism**: a force produced by magnets that pulls some metals. **matter:** anything that takes up space and has weight. All matter is made of moving particles. **mixture**: a combination of materials; the materials do not change into something else after they are mixed. **particles:** all matter is made up of smaller pieces of matter.

physical changes: changes in a state from a solid to a liquid and back again.
solubility: the ability of one substance to dissolve another; a physical change in matter.
state change: a change of a substance from one state of matter to another. Some common state changes include: melting, and freezing.
states of matter: solid, liquid, gas.
substances: a material where each part of it is made of the same type of particle. No two particle types have exactly the same properties.
temperature: degree or intensity of heat present in a substance or object.
thermal conductivity: a property that describes how well a substance allows heat to pass through it.
time: an elapse of an event.

Instructional Materials and Learning Activities

Core Instructional Materials:

- *National Geographic Exploring Science 5*
- *National Geographic My NG connect Exploring Science 5 Digital Resources*
- *National Geographic Exploring Science through Literacy*
- *Hand2Mind Exploring Science Hands on Kit*

Digital Resources:

- Access the Next Generation Science Standards by Topic - The NGSS standards
- www.inquiryinaction.org - chemistry lab experiments
- http://www.chem4kids.com - background information for students
- PhET - online simulations
- STEM Resource Finder - online simulations (some require Java)
- http://ngss.nsta.org/Classroom-Resources.aspx - lesson ideas
- http://sciencespot.net/Pages/refdeskNextGen.html - lesson ideas
- https://www.generationgenius.com/

Supplemental Materials:

- *Delta Science* Readers
- Discovery Education: Streaming Plus & Science Tech Book

Leveled Readers:

Level Reader	Below-Level	On-Level	Above-Level

The Sinking of the Titanic	860L	940L	1010L
The World's Ocean	780L	910L	1000L

Suggested Modifications

These strategies can be adapted to scaffold for students needing more support or extending the learning for higher level students. Differentiation is accomplished through content, process, product, and learning environment.

NGSS Appendix D - "All Standards, All Students": Making the Next Generation Science Standards Accessible to All Students

Special Education Students
• To help students understand the structure and properties of matter, provide them with sentence frames and have them draw pictures of different characteristics. • Help students complete sentence stems that list two ways matter can change state. Provide these stems: *A change of state from gas to liquid occurs when . . . A change of state from liquid to solid occurs when . . .* • Provide sentence frames, such as: *A chemical change (is) occurring if heat is given off. A chemical change (is) occurring if light is produced.* • Help students complete a sentence stem that identifies odor as a clue that indicates a chemical change has occurred. Provide this stem: *Even if you could not see or feel the effects of a chemical change, you might still know one has occurred because . . .* • Extended time for assignment • Prompting • Reassurance • Time to formulate ideas • Use of visual clues when reading • Preferential seating • Repeated directions • Instructional Aides in the classroom setting • Peer models • Preview content vocabulary and schema • Use of FM system to improve attention and support auditory information • Behavior chart to increase focus and work completion • Sensory breaks • Chromebook extensions *(text-to-speech)* • Graphic organizers
Students at Risk
• Help students complete sentence stems that list two ways matter can change state. Provide these

stems: *A change of state from gas to liquid occurs when . . . A change of state from liquid to solid occurs when . . .*
- Provide sentence frames, such as: *A chemical change (is) occurring if heat is given off. A chemical change (is) occurring if light is produced.*
- Help students complete a sentence stem that identifies odor as a clue that indicates a chemical change has occurred. Provide this stem: *Even if you could not see or feel the effects of a chemical change, you might still know one has occurred because . . .*
- Response to intervention - targeted skill/goal improvement plans within a set time frame
- Multisensory manipulatives
- Preferential seating
- Behavior chart to increase focus and work completion
- Use of FM system to improve attention and support auditory information
- Sensory breaks
- Chromebook extensions *(text-to-speech)*
- Leveled texts
- Audio books
- Consultation with academic support teachers to address skills identified by the classroom teacher
- Modification of assignments and assessments
- Splitting up open ended components of assessments into manageable tasks

English Language Learners

- Ask yes/no questions, such as: Does condensation cause a change of state? (Yes.) Does freezing cause a change of state? (Yes.)
- Provide sentence frames, such as: *Condensation produces a change of state from a (gas) to a (liquid). Melting produces a change of state from a (solid) to a (liquid).*
- Help students complete sentence stems that list two ways matter can change state. Provide these stems: *A change of state from gas to liquid occurs when . . . A change of state from liquid to solid occurs when . . .*
- Ask yes/no questions, such as: Is a change of state a sign of a chemical change? (No.) Is the giving off of a new odor a sign of a chemical change? (Yes.)
- Provide sentence frames, such as: *A chemical change (is) occurring if heat is given off. A chemical change (is) occurring if light is produced.*
- Help students complete a sentence stem that identifies odor as a clue that indicates a chemical change has occurred. Provide this stem: *Even if you could not see or feel the effects of a chemical change, you might still know one has occurred because . . .*
- Collaborate with English Language teacher. Preview content vocabulary *(with pictures and labels in the student's first language)*
- Visual clues (pictures)
- Repeated directions
- Check for understanding
- Ask pointed questions
- Peer models
- English language supports for parents of non English speaking students
- Use of iPad for translation between English and the student's first language
- Materials presented at lower TC levels

- Audio books
- Use of interactive English vocabulary websites *(Learning Chocolate)*
- Small flip book of content specific vocabulary with translations and pictures

Gifted and Talented

- Challenge questions and higher level thinking while reading both fiction and nonfiction texts
- Higher TC level texts
- Advanced STEAM activities
- Assigned leadership roles within class

Students with 504 Plans

- Help students complete sentence stems that list two ways matter can change state. Provide these stems: *A change of state from gas to liquid occurs when . . . A change of state from liquid to solid occurs when . . .*
- Provide sentence frames, such as: *A chemical change (is) occurring if heat is given off. A chemical change (is) occurring if light is produced.*
- Help students complete a sentence stem that identifies odor as a clue that indicates a chemical change has occurred. Provide this stem: *Even if you could not see or feel the effects of a chemical change, you might still know one has occurred because . . .*
- Extended time for assignment
- Prompting
- Reassurance
- Time to formulate ideas
- Use of visual clues when reading
- Preferential seating
- Repeated directions
- Instructional Aides in the classroom setting
- Peer models
- Preview content vocabulary and schema
- Use of FM system to improve attention and support auditory information
- Behavior chart to increase focus and work completion
- Sensory breaks
- Chromebook extensions *(text-to-speech)*
- Graphic organizers

Appendix A
3-5 Engineering Design Standards

Students who demonstrate understanding can:
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.

Disciplinary Core Ideas

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 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)

Science and Engineering Practices

Asking Questions and Defining Problems

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

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)

Influence of Science, Engineering, and Technology on Society and the Natural World

People's needs and wants change over time, as do their demands for new and improved technologies. (3- 5-ETS1-1)

- Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands. (3-5-ETS1-2)