Willingboro
Public Schools

"Where Excellence is the Expectation"

Willingboro Public Schools
Grade 5 Science Curriculum

Revised April 2025

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Course Sequence/Table of Contents:

Click here for the Grade 5 Science Pacing Guide

Overview	Standards for Science Content	Unit Focus
Unit 1 Ecosystems & Matter Cycling	● **5-PS1-1** ● **5-PS3-1** ● **5-LS1-1** ● **5-LS2-1**	● Develop a model to describe that matter is made of particles too small to be seen. ● Use models to describe that energy in animals' food (used for body repair, growth, and motion and to maintain body warmth) was once energy from the sun. ● Support an argument that plants get the materials they need for growth chiefly from air and water. ● Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.
Unit 1: Ecosystems & Matter Cycling	● FOSS Next Generation Science Curriculum Resources ○ Think Link ○ Student Resource Books ● Generation Genius	

Overview	Standards for Science Content	Unit Focus
Unit 2 **Matter Properties**	● **5-PS1-1** ● **5-PS1-2** ● **5-PS1-3** ● **5-PS1-4** ● **ETS1-1** ● **ETS1-3**	● Develop a model to describe that matter is made of particles too small to be seen. ● 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. ● Make observations and measurements to identify materials based on their properties. ● Conduct an investigation to determine whether the mixing of two or more substances results in new substances. ● Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost. ● Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.
Unit 2: ***Matter Properties***	● FOSS Next Generation Science Curriculum Resources ○ Think Link ○ Student Resource Books ● Generation Genius	
Unit 3 **Earth Systems**	● **5-PS1-1** ● **5-PS2-1** ● **5-ESS1-1** ● **5-ESS1-2** ● **5-ESS2-1** ● **5-ESS2-2** ● **5-ESS3-1** ● **3-5-ETS1-1** ● **3-5-ETS1-2** ● **3-5-ETS1-3**	● Develop a model to describe that matter is made of particles too small to be seen. ● Support an argument that the gravitational force exerted by Earth on objects is directed down. ● Support an argument that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from Earth. ● Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night sky. ● Develop a model using an example to describe the geosphere, biosphere, hydrosphere, and/or atmosphere. ● Describe and graph the amounts of salt water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth. ● Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources, environment, and address climate change issues. ● Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost. ● 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. ● Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.
Unit 3: *Earth Systems*	● FOSS Next Generation Science Curriculum Resources ○ Think Link ○ Student Resource Books ● Generation Genius	

Overview	Standards for Science Content	Unit Focus
Unit 4 Earth and Sun	● **5-PS2-1** ● **5-ESS1-1** ● **5-ESS1-2**	● Support an argument that the gravitational force exerted by Earth on objects is directed down. ● Support an argument that differences in the apparent brightness of the sun compared to other stars are due to their relative distances from Earth. ● 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.
Unit 4: Earth and Sun	● FOSS Next Generation Science Curriculum Resources ○ Think Link ○ Student Resource Books ● Generation Genius	

Unit 1 - Ecosystems & Matter Cycling	
Overview	
In this unit, students explore the hidden life within these logs—known as nurse logs—to uncover how they support entire ecosystems. Through hands-on investigations and modeling, students discover how plants growing on nurse logs get the matter they need primarily from air and water and the energy they need from the Sun. They explore how energy and matter flow through this micro-ecosystem, supporting not just plants, but a variety of animals and decomposers. As students deepen their understanding of energy and matter transfer, they learn that decomposers play a vital role in breaking down the log, releasing nutrients that sustain new life. Students use models to explain the relationships among the nurse log, the plants and animals that interact with it, and the role of sunlight in fueling this system. The unit concludes with an exploration of how introducing new species—like the American bullfrog—can disrupt the delicate balance of these ecosystems, prompting students to consider the impact of environmental change and species introduction.	
Essential Questions	**Enduring Understandings**
● How does a nurse log help other things live and grow?	● A nurse log plays a vital role in forest ecosystems by providing nutrients, moisture, and shelter, creating a supportive environment that helps new plants, fungi, and animals grow and thrive. This process shows how life in nature is interconnected and how one organism's decay can support the growth of others.

Content Standards	Critical Knowledge	Critical Skills

• **5-PS1-1 -** Develop a model to describe that matter is made of particles too small to be seen.
 	
• **5-PS3-1 -** Use models to describe that energy in animals' food (used for body repair, growth, and motion and to maintain body warmth) was once energy from the sun.
 	
• **5-LS1-1 -** Support an argument that plants get the materials they need for growth chiefly from air and water.
 	
• **5-LS2-1 -** Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.
	• Understanding the Particle Model of Matter
	  ○ Matter is made up of tiny particles (atoms or molecules) that are too small to be seen with the naked eye.
	  ○ All substances are made of matter, regardless of state (solid, liquid, gas).
	  ○ The arrangement and motion of these particles determine the state and properties of matter.
	
	• Evidence of Particles Too Small to See
	  ○ Observable phenomena (like dissolving, diffusion, or compression of gases) can be explained by the presence of unseen particles.
	  ○ Scientific tools and models are used to help visualize and explain what cannot be directly observed.
	
	• Properties and Behavior of Particles
	  ○ Particles are constantly in motion.
	  ○ The space between particles changes based on the state of matter and energy input (e.g., heating or cooling).
	  ○ Matter retains its mass even when divided into smaller parts or mixed.
	• Energy Origins
	  ○ The energy animals use comes from the food they eat.
	  ○ That food energy originally comes from the Sun.
	
	• Photosynthesis as the Starting Point
	  ○ Plants capture sunlight and convert it into chemical energy through photosynthesis.
	  ○ Plants store this energy in the form of sugars (glucose), which form the base of food chains.
		• Model Development
		  ○ Construct and refine models (physical, diagrammatic, digital, etc.) to represent particles and their behavior in different states of matter.
		  ○ Use models to explain and predict how matter behaves during phase changes or mixing.
		
		• Scientific Reasoning
		  ○ Use evidence from experiments and observations (e.g., sugar dissolving in water, air compressing) to support the particle model.
		  ○ Communicate explanations using appropriate scientific vocabulary (e.g., particle, atom, molecule, diffusion).
		
		• Observation and Inference
		  ○ Differentiate between what is directly observed and what is inferred about particles.
		  ○ Relate invisible processes (like the spread of a smell) to the motion of particles.
		
		• Collaboration and Communication
		  ○ Work with peers to compare models and refine ideas based on feedback and evidence.
		  ○ Present models clearly using drawings, labels, and oral or written explanations.
		• Modeling
		  ○ Create, use, and revise models (e.g., food chains, food webs, energy pyramids) to show energy flow from the Sun to animals.
		  ○ Use arrows and labels to clearly represent energy sources, transfers, and transformations.
		
		• Scientific Explanation

Content Standards	Critical Knowledge	Critical Skills

	• Energy Transfer Through Food Chains
	  ○ When animals eat plants (or other animals), they obtain stored energy.
	  ○ Energy is transferred from the Sun → to plants → to herbivores → to carnivores and omnivores.
	
	• Uses of Energy in Animals
	  ○ Animals use energy from food for body repair, growth, movement, and maintaining body warmth.
	  ○ Not all energy is passed on; some is lost as heat or used in daily functions.
	
	• Role of Models
	  ○ Models help represent and explain how energy flows from the Sun to producers and then to consumers in an ecosystem.
	
	• Sources of Plant Growth Material
	  ○ Plants do not get most of their mass from soil.
	  ○ The main materials plants use for growth come from carbon dioxide in the air and water from the ground.
	
	• Photosynthesis Basics
	  ○ Plants use sunlight to power the process of photosynthesis, which combines carbon dioxide and water to produce sugars that help the plant grow.
	  ○ Oxygen is released as a byproduct.
	
	• Misconceptions About Soil
	  ○ While soil provides important nutrients and support, it does not contribute significantly to the mass of a growing plant.
		○ Explain how energy in an animal's food can be traced back to the Sun using models and scientific reasoning.
		○ Use evidence to support the idea that energy is not created by animals but transferred from one source to another.
		
		○ System Thinking
		  ■ Recognize patterns and relationships between organisms in a food web.
		  ■ Understand the role of producers, consumers, and decomposers in energy flow.
		
		○ Communication
		  ■ Clearly describe and present models using appropriate scientific vocabulary (e.g., producer, consumer, energy transfer, photosynthesis).
		○ Collaborate with peers to critique and refine models for accuracy and clarity.
		
		• Constructing Arguments
		  ○ Make a claim about where plants get the materials for growth.
		  ○ Use evidence (e.g., results from plant investigations) and logical reasoning to support the claim.
		
		• Planning and Conducting Investigations
		  ○ Design and carry out experiments that explore what plants need to grow (e.g., plants grown without soil, with only air and water).
		  ○ Record, interpret, and analyze data related to plant growth.

Content Standards	Critical Knowledge	Critical Skills
	○ Most of the plant's mass comes from the carbon in carbon dioxide. ● Argument from Evidence ○ Scientific arguments are based on evidence and reasoning, not just opinions. ○ Data from investigations (like plant growth experiments) can support claims about where plants get materials. ● Matter Cycles Through Ecosystems ○ Matter is not created or destroyed; it cycles among the living (plants, animals, decomposers) and nonliving parts of an ecosystem (air, water, soil). ● Roles of Organisms in the Matter Cycle ○ Plants use sunlight, water, and carbon dioxide to grow, storing matter in their structures. ○ Animals consume plants or other animals, using the matter for energy, growth, and repair. ○ Decomposers (like fungi, bacteria, and worms) break down dead plants and animals, returning matter to the soil and air. ● The Environment's Role ○ The air, water, and soil provide essential materials for life and receive matter back through processes like respiration, decay, and waste. ● Matter vs. Energy ○ Matter cycles within the ecosystem, while energy flows and is eventually lost as heat. ○ Understanding this difference is key to modeling ecosystem function.	● Scientific Communication ○ Use scientific vocabulary (e.g., photosynthesis, carbon dioxide, matter, evidence, claim) to explain findings. ○ Present arguments clearly in written or oral form using the Claim-Evidence-Reasoning (CER) framework. ● Modeling ○ Create diagrams or models to show how air and water contribute to plant growth. ○ Use models to visualize photosynthesis and the movement of matter into the plant. ● Developing and Using Models ○ Create and refine models (drawings, diagrams, physical models) that show how matter moves among plants, animals, decomposers, and the environment. ○ Use arrows and labels to show the flow and transformation of matter. ● Analyzing and Interpreting Data ○ Use observations, videos, and investigations to gather evidence of matter cycling (e.g., composting, food webs, decomposition). ○ Identify patterns that show how living things rely on each other and the environment. ● Constructing Explanations ○ Explain how the matter in dead organisms and waste products becomes part of the environment again through the action of decomposers.

Content Standards	Critical Knowledge	Critical Skills

	• Models Show Relationships
	  ○ Models (e.g., diagrams or flowcharts) help explain how matter moves and changes form as it passes through organisms and the environment.
		○ Use science vocabulary to describe interactions and transformations (e.g., consume, decompose, release, absorb).
		
		• System Thinking
		  ○ Understand how ecosystems are systems where parts work together, and how a change in one part (e.g., fewer decomposers) affects the whole.
		  ○ Identify cause-and-effect relationships within the matter cycle.
		
		• Communicating Scientific Ideas
		  ○ Use models and explanations to clearly communicate how matter moves through ecosystems.
		  ○ Present ideas in writing, discussion, and visual formats using evidence from investigations.

Integrated Accommodations and Modifications		
Special Education Students	**English Language Learners**	**At Risk**
• Utilize modifications & accommodations delineated in the student's IEP • Provide additional manipulatives to support instruction • Allow for alternative strategies to solve algorithms or tasks • Provide the steps needed to complete the task • Model frequently • Provide repetition and practice. • Use visuals to demonstrate/model the processes • Restate, reread, and clarify directions/questions	WIDA Can Do Descriptors https://wida.wisc.edu/teach/can-do/descriptors • Modify Assignments • Use testing and portfolio assessment • Utilize Native Language Translation (peer, online assistive technology, translation device, bilingual dictionary) • Repeat, rephrase, paraphrase key concepts and directions • Allow for extended time for assignment completion as needed • Highlight key vocabulary • Define essential vocabulary in context	• Pair visual prompts with verbal presentations • Ask students to restate information, directions, and assignments. • Provide repetition and practice • Model skills /techniques to be mastered. • Provide extended time to complete class work • Provide a copy of class notes • Provide preferential seating to be mutually determined by the student and teacher • Allow the use of a computer to complete assignments.

● Ask students to restate information, directions, and assignments. ● Provide a copy of class notes ● Distribute study guide for classroom tests. ● Provide preferential seating to be mutually determined by the student and teacher ● Provide extra textbooks for home. ● Provide regular parent/ school communication ● Allow extended time to complete assignment ● Establish procedures for accommodations / modifications for assessments ● Allow student to take/complete tests in an alternate setting as needed Appendix A: Special Education Accommodations and Modifications	● Use graphic organizers, visuals, manipulatives, and other concrete materials ● Use gestures, facial expressions, and body language ● Read aloud ● Build on what students already know and prior experience	● Establish expectations for correct spelling on assignments ● Provide extra textbooks for home. ● Provide Peer Support ● Increase one on one time

Gifted and Talented Students	**504 Plan**
● Utilize advanced, accelerated, or compacted content ● Provide assignments that emphasize higher- level thinking skills. ● Allow for individual student interest ● Gear assignments to development in areas of affect, creativity, cognition, and research skills ● Allow for a variety in types of resources ● Provide problem-based assignments with planned scope and sequence ● Utilize inquiry-based instruction ● Adjust the pace of lessons ● Utilize Choice Boards ● Provide Problem-Based Learning ● Establish flexible Grouping	● Pair visual prompts with verbal presentations ● Ask students to restate information, directions, and assignments. ● Provide repetition and practice ● Model skills/techniques to be mastered. ● Provide extended time to complete class work ● Provide a copy of class notes ● Break long assignments into smaller parts ● Assist students in setting short-term goals ● Allow for preferential seating to be mutually determined by the student and teacher ● Provide extra textbooks for home. ● Model and reinforce organizational systems (i.e. color-coding) ● Write out homework assignments, check students' recording of assignments
Interdisciplinary Connections	**Computer Science and Design Thinking**
ELA Standards ● SL.6.1. Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grade	**Computer Science and Design Thinking Practices** ● Fostering an Inclusive Computing and Design Culture ● Collaborating Around Computing and Design ● Recognizing and Defining Computational Problems

6* topics, texts, and issues, building on others' ideas and expressing their own clearly.
- L.6.6. Acquire and use accurately grade appropriate general academic and domain specific words and phrases; *gather vocabulary knowledge when considering a word or phrase important to comprehension or expression. *
- W.6.10. Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences

Mathematics Standards
- 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)
- 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)
- 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)
- 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)
- 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.

- Developing and Using Abstractions
- Creating Computational Artifacts
- Testing and Refining Computational Artifacts
- Communicating About Computing and Design

Computer Science and Design Thinking Standards
- 8.2.8.ED.3: Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch).
- 8.1.8.DA.1: Organize and transform data collected using computational tools to make it usable for a specific purpose.

Career Readiness, Life Literacies and Key Skills

Career Readiness, Life Literacies and Key Skills Practices

- Act as a responsible and contributing community member and employee.
- Attend to financial well-being.
- Consider the environmental, social and economic impacts of decisions.
- Demonstrate creativity and innovation.
- Utilize critical thinking to make sense of problems and persevere in solving them.
- Model integrity, ethical leadership and effective management.
- Plan education and career paths aligned to personal goals.
- Use technology to enhance productivity, increase collaboration and communicate effectively.
- Work productively in teams while using cultural/global competence.

Career Readiness, Life Literacies and Key Skills Standards

9.1 Personal Financial Literacy

- 9.1.8.CR.2: Compare various ways to give back through strengths, passions, goals, and other personal factors.
- 9.1.8.CP.1: Compare prices for the same goods or services.
- 9.1.8.CP.2: Analyze how spending habits affect one's ability to save.
- 9.1.8.CP.3: Explain the purpose of a credit score and credit record, the factors and impact of credit scores.
- 9.1.8.FP.3: Explain how self-regulation is important to managing money (e.g., delayed gratification, impulse buying, peer pressure, etc.).
- 9.1.8.FP.5: Determine how spending, investing, and using credit wisely contributes to financial well-being.

9.2 Career Awareness, Exploration, Preparation, and Training

- 9.2.8.CAP.1: Identify offerings such as high school and county career and technical school courses, apprenticeships, military programs, and dual enrollment courses that support career or occupational areas of interest.
- 9.2.8.CAP.2: Develop a plan that includes information about career areas of interest.
- 9.2.8.CAP.3: Explain how career choices, educational choices, skills, economic conditions, and personal behavior affect income.

9.4 Life Literacies and Key Skills

21st Century Skills

- 9.4.8.CI.1: Assess data gathered on varying perspectives on causes of climate change (e.g., crosscultural, gender-specific, generational), and determine how the data can best be used to design multiple potential solutions (6.SP.B.5)
- 9.4.8.GCA.2: Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a group goal.

Technology Integration

- 9.4.8.IML.3: Create a digital visualization that effectively communicates a data set using formatting techniques such as form, position, size, color, movement, and spatial grouping. (6.SP.B.4)
- 9.4.8.IML.4: Ask insightful questions to organize different types of data and create meaningful visualizations.
- 9.4.8.TL.3: Select appropriate tools to organize and present information digitally.

SEL Competencies

- **Self - Awareness**

- **Self - Management**
- **Social Awareness**
- **Responsible Decision Making**
- **Relationship Skills**

https://www.nj.gov/education/safety/wellness/selearning/index.shtml

Anchoring Phenomenon
How does a nurse log help other things live and grow? Lesson 1: Many things live and grow on/around fallen trees (nurse logs). Lesson 2: Moss is an important component of the nurse log system. Lesson 3: Plants get heavier in weight as they grow. Lesson 4: Plants growing with different factors gain or lose matter over time. Lesson 5: A basketball is a way to trap air to weigh it. Lesson 6: The Sun can give energy to things so they can move and change. Lesson 7: Some places better support plant growth than others. Lesson 8: Nurse logs seem to disappear over time. Lesson 9: Pillbugs and birds use energy from food for many different things. Lesson 10: Nurse log habitats help salamanders survive. Lesson 11: Termites can digest wood. Lesson 12: Mushrooms grow on living and once-living things. Lesson 13: A system needs decomposers to cycle matter. Lesson 14: American bullfrogs have become part of new food webs. Lesson 15: Matter and energy flow through a grassland ecosystem.

District/School Formative Assessment Plan	District/School SummativeAssessment Plan
Formative assessment informs instruction and is ongoing throughout a unit to determine how students are progressing against the standards. Teachers are encouraged to incorporate Formative Assessments into all lessons. During instruction, teachers will collect ongoing information on students' mastery of content through a variety of methods: ● Questioning: using Socratic method, probing questions, a hierarchical system in complexity (Bloom's Taxonomy)	**Summative Assessments (Synthesis of Understanding)** **Final Model and Written Explanation** ● Students create a final, annotated model of the nurse log ecosystem: ○ Show flow of energy (from Sun through plants → consumers → decomposers). ○ Show cycling of matter (air/water → plants → decomposers → soil

● Exit tickets, rotational activities (stations), quizzes, and small group activities ● Classwork, homework, group work (formative assessment) ● Pre-Assessment, teacher's observation, class discussion, and journal	● Accompanied by a short written or oral explanation describing key relationships. **Scenario-Based Application Task** ● Given a *new phenomenon* (e.g., a forest with few decomposers, or the introduction of an invasive species), students: ○ Predict what might happen to the ecosystem. ○ Support their prediction with evidence from the unit. **Performance Assessment: Micro-Ecosystem Design** ● Students design a micro-ecosystem (on paper or as a model) that would support plants, decomposers, and small animals. ● Explain how energy and matter move through their system, and how their choices support life. **Argument from Evidence Task** ● Given data (e.g., graph of plant growth on nurse logs vs. bare soil, chart of decomposer numbers before/after bullfrog introduction), students construct a written argument: *What does the data show? How do they support your claim?*

Focus Scientific Concepts

Targeted Academic Vocabulary

Nurse Log – A fallen, decaying tree that provides nutrients, moisture, and shelter for plants, animals, and fungi, helping new life grow.

Ecosystem – A community of living organisms and their physical environment interacting together.

Decomposer – An organism, such as fungi or bacteria, that breaks down dead plant and animal matter, recycling nutrients back into the ecosystem.

Matter – Anything that has mass and takes up space; in this unit, refers to the physical substances plants and animals need to grow.

Energy – The ability to do work or cause change; in ecosystems, energy mainly comes from the Sun and is used by plants to grow.

Photosynthesis – The process by which green plants use sunlight, carbon dioxide, and water to make their own food and release oxygen.

Nutrient – A substance that provides nourishment essential for growth and life, such as nitrogen or phosphorus.

Micro-ecosystem – A small-scale ecosystem, like that of a nurse log, where living and nonliving things interact in a limited space.

Model – A representation used to explain or predict how something works, such as the flow of matter and energy in an ecosystem.

Matter Cycle – The movement of matter through living and nonliving parts of an ecosystem, including processes like decomposition and plant growth.

Energy Transfer – The movement of energy from one part of an ecosystem to another, such as from the Sun to plants, and then to animals.

Species Introduction – When a new species is brought into an ecosystem, either naturally or by humans, which can disrupt existing relationships.

Invasive Species – A non-native species that spreads rapidly in a new environment and often harms native species or ecosystems.

Environmental Change – Any alteration to an ecosystem, whether natural or human-caused, that can affect the organisms living there.

Biodiversity – The variety of living organisms in a particular ecosystem; higher biodiversity often leads to a healthier, more resilient system.

District/School Primary and Supplementary Resources

Primary:

Anchoring Video or Image Set

- Time-lapse or still photos of a fallen log over time showing plant growth, fungi, insect visits, and decomposition.
- Used to spark initial student questions: What's happening on and inside the log? Why?

Student Wonder Board Template

- A shared space (chart paper or digital) where students post questions and noticings about the nurse log ecosystem at the start and throughout the unit.

Observation Data Sheets

- Graphic organizers for students to record detailed noticings from examining wood samples, terrariums, or outdoor logs (e.g., color, moisture, growths, presence of organisms).

Micro-Ecosystem Jar Set-Up Guide

- Directions for creating a jar ecosystem with decaying wood, moss, and soil to observe changes over time.

Decomposer Sampling Protocol

- Simple field guide pages or keys to help students identify decomposers (e.g., slugs, fungi, beetles) in their samples or photos.

Energy and Matter Flow Model Template

- A diagram with boxes and arrows for students to map:

- Sunlight → Plants → Animals → Decomposers
- Air/water → Matter into plants → Matter into decomposers

Cause and Effect Map on Species Introduction
- A chart where students track What happens if…? when new species (e.g., bullfrog) or changes (e.g., less sunlight) are introduced.

Public Model Wall or Digital Jamboard Space
- To track the class's evolving system models (drawings or digital diagrams) as they collect evidence across lessons.

Species Cards (Nurse Log Organisms)
- Fact sheets on key players: ferns, mosses, fungi, beetles, salamanders, birds, etc.
- Includes roles in the ecosystem (producer, consumer, decomposer) and connections to matter/energy flow.

Bullfrog Impact Fact Sheet
- Student-friendly resource on American bullfrog diet, habitat needs, and ecosystem effects.

Driving Question Board
- Used throughout the unit to revisit and refine the big questions students are investigating.
- Example starter: How do nurse logs support so many living things?

Supplementary:

Short Articles / Informational Texts
- "How Decomposers Keep Forests Alive" – Age-appropriate article explaining roles of fungi, bacteria, and invertebrates in recycling matter.
- "The Secret Life of Nurse Logs" – Simple reading with photos/diagrams showing how nurse logs support new plant growth.

Data Sets from Real Forest Studies
- Tables or graphs showing:
  - Plant growth rates on nurse logs vs. soil.
  - Decomposition rates under different moisture conditions.
  - Species diversity on/near nurse logs.

Impact Reports on Invasive Species (Bullfrog Example)
- Student-friendly summaries or infographics describing the American bullfrog's diet, habitat, and impact on native species.

Time-Lapse / Documentary Clips
- Short videos showing:
  - A log decaying over time.
  - Fungi spreading on a fallen log.

- Small animals interacting with a nurse log (e.g., salamanders, beetles).

Case Studies of Forest Restoration / Management
- Short reports or videos on how foresters use fallen logs to restore habitats or how invasive species disrupt ecosystems.

Engineering Design Examples
- Articles or videos showing how people create structures (e.g., artificial logs, habitat piles) to support wildlife or promote decomposition.

Stories or Articles on Traditional Ecological Knowledge (TEK)
- Readings on how Indigenous communities recognize the role of fallen logs and decomposers in sustaining forest life.
- Example: How Coast Salish or Haida stories reflect an understanding of nurse log cycles.

Energy Flow and Matter Cycle Diagrams
- Simple diagrams from scientific sources showing how sunlight, air, and water fuel forest ecosystems through producers, consumers, and decomposers.

Forest Food Web Infographics
- Visuals showing the interconnections between plants, decomposers, insects, amphibians, birds, and mammals in a forest.

Instructional Best Practices and Exemplars
See Appendix B for Instructional Best Practices and Exemplars
Pacing Guide
Grade 5 Pacing Guide

Unit 2 - Matter Properties
Overview
Water is essential to life—so vital that many cultures honor it with the phrase, “Water Is Life.” In this unit, students explore what makes water healthy or unhealthy for living things by investigating natural and human-made water systems. Through hands-on experiments, modeling, and research, students learn how to evaluate water quality and design ways to improve it. The unit begins with students analyzing four different water samples—lake water, pool water, metallic water, and rainwater. They observe physical properties, identify materials in the water, and construct models to explain what might affect each sample’s health. As students begin to explore water purification, they design and build filters to remove visible contaminants. However, they soon realize that filtering alone does not remove all harmful particles.

To further their investigations, students test boiling as a purification method and analyze second-hand data to evaluate its effectiveness—finding it works in only some cases. They also explore solar stills and discover their benefits and limitations. Shifting to larger-scale solutions, students research real-world water treatment techniques and experiment with adding substances to remove pollutants.

By the end of the unit, students apply their understanding of science and engineering to tackle a real-world water quality issue—developing, testing, and refining solutions to improve water for different living things and purposes. Through this process, they learn that clean water requires a combination of observation, creativity, and scientific problem-solving.

Essential Questions	Enduring Understandings
● How can we make water healthy for all living things?	● Water is essential for all living things, and its quality affects the health of ecosystems and communities. By understanding how water becomes polluted and learning how to protect and restore it, people can take action to ensure clean, safe water for plants, animals, and humans. Responsible choices and sustainable practices help keep water sources healthy now and for the future.

Unit 2 - Matter Properties

Content Standards	Critical Knowledge	Critical Skills
● **5-PS1-1 -** Develop a model to describe that matter is made of particles too small to be seen. ● **5-PS1-2 -** Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved. ● **5-PS1-3 -** Make observations and measurements to identify materials	● Definition of Matter ○ Matter is anything that has mass and takes up space. ● Particles Make Up Matter ○ All matter is made of tiny particles (atoms or molecules) that are too small to be seen with the naked eye. ● Behavior of Particles ○ Particles in matter are always moving, and their arrangement depends on the state of matter (solid, liquid, gas). ○ The properties of matter (e.g., shape, volume, compressibility) are related to how its particles are arranged and behave. ● Evidence of Particles ○ Observable phenomena (like dissolving, diffusion, or mixing) suggest that matter is	● Developing Models ○ Create and use models (drawings, diagrams, simulations, or physical models) to show that matter is made of particles. ○ Represent particle behavior in different states of matter using labeled illustrations or 3D models. ● Observing and Inferring ○ Observe real-world phenomena (e.g., sugar dissolving in water) and make inferences about unseen particles based on evidence. ● Scientific Explanation ○ Explain how models show that matter is made of particles too small to see. ○ Use appropriate vocabulary (e.g., particles, matter, atoms, molecules) to describe what models represent.

Unit 2 - Matter Properties		
Content Standards	**Critical Knowledge**	**Critical Skills**
based on their properties. ● **5-PS1-4 -** Conduct an investigation to determine whether the mixing of two or more substances results in new substances. ● **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. ● **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.	made of particles, even though we can't see them directly. ● Models in Science ○ Scientists use models to represent ideas or processes that are too small, large, or complex to observe directly. ● Conservation of Matter ○ Matter is not created or destroyed during physical or chemical changes. ○ The total weight (mass) of substances remains the same even when they change form (e.g., melt, freeze, mix, dissolve). ● Types of Changes in Matter ○ Physical changes include melting, freezing, boiling, and dissolving. ○ Chemical changes may include reactions that create new substances (e.g., rusting, cooking). ○ Even when substances change form, their total weight stays constant (in a closed system). ● Closed vs. Open Systems ○ In a closed system, no matter enters or leaves, making it easier to observe conservation of matter. ○ In an open system, changes may appear to "lose" matter due to evaporation or spillage, but the matter still exists. ● Importance of Measurement ○ Measuring the weight of substances before and after a change provides evidence of matter	● Analyzing Data and Patterns ○ Analyze experimental results to find patterns that support the particle model (e.g., no mass change when substances dissolve). ○ Identify patterns that explain how invisible particles behave in observable ways. ● Communicating Ideas ○ Present and explain models to others through writing, speaking, and visual representations. ○ Revise models based on peer feedback and new evidence. ● Measuring Matter ○ Accurately use scales or balances to measure the weight of solids and liquids before and after heating, cooling, or mixing. ○ Understand and record weights using appropriate units (grams, kilograms). ● Designing and Conducting Investigations ○ Plan and carry out investigations that include heating, cooling, or mixing substances. ○ Control variables and observe changes while maintaining accurate records. ● Graphing Data ○ Create bar graphs or line plots to compare the total weight of substances before and after changes. ○ Interpret graphs to identify patterns and support conclusions. ● Analyzing and Interpreting Data ○ Use collected data to make claims about the conservation of matter.

Unit 2 - Matter Properties		
Content Standards	**Critical Knowledge**	**Critical Skills**
	conservation. ● Definition of Properties ○ Materials have observable and measurable properties that help identify them. ○ Common properties include color, texture, hardness, flexibility, luster, magnetism, conductivity, solubility, and melting/boiling point. ● Importance of Properties ○ Different materials may look similar but can be distinguished by their unique properties. ○ Properties determine how materials are used and how they behave in different conditions. ● Scientific Tools and Units ○ Tools such as rulers, thermometers, balances, magnets, and conductivity testers help measure properties accurately. ○ Units like grams (mass), degrees Celsius (temperature), and centimeters (length) are used to record observations. ● Observations vs. Inferences ○ Observations are direct evidence collected through the senses or tools. ○ Inferences are explanations or conclusions drawn from those observations. ● Understanding Physical vs. Chemical Changes ○ Physical change: A change in form or appearance, but no new substance is created (e.g., dissolving sugar in water).	○ Identify patterns in data that show consistent total weight despite changes in form or appearance. ● Constructing Explanations with Evidence ○ Develop scientific explanations that connect observed changes to the idea of matter conservation. ○ Use data and visuals (graphs or charts) to support claims. ● Communicating Findings ○ Present and explain investigation results using clear language, graphs, and reasoning. ○ Collaborate with peers to compare findings and discuss possible sources of error or variation. ● Making Observations ○ Observe materials using the five senses and scientific tools. ○ Record physical properties accurately and consistently. ● Measuring Accurately ○ Use tools such as balances, thermometers, and rulers to measure mass, temperature, length, and volume. ○ Record measurements with correct units. ● Comparing and Classifying ○ Compare different materials based on multiple properties. ○ Classify or sort materials into groups based on shared characteristics. ● Identifying Materials

Unit 2 - Matter Properties		
Content Standards	**Critical Knowledge**	**Critical Skills**
	○ Chemical change: A reaction where two or more substances form one or more new substances with different properties (e.g., baking soda and vinegar producing gas). ● Signs of a Chemical Change ○ Formation of gas (bubbling, fizzing) ○ Change in temperature (hotter or colder) ○ Color change ○ Formation of a solid (precipitate) ○ Production of light or odor ● Properties of Substances ○ Substances have specific physical and chemical properties. ○ New substances will show different properties than the original substances. ● Purpose of Scientific Investigations ○ Investigations help test ideas and answer questions through observation and evidence. ● Understanding a Design Problem ○ A design problem starts with a need or a want—something people are trying to fix, improve, or create. ● Criteria for Success ○ Criteria are the specific features a solution must have to be considered successful (e.g., must be waterproof, must carry a certain weight). ● Constraints	○ Use collected data and observations to identify unknown substances based on their unique set of properties. ● Analyzing and Interpreting Data ○ Create tables or charts to organize observed data. ○ Analyze data patterns to determine which properties are most useful for identifying materials. ● Constructing Explanations ○ Use evidence from observations and measurements to explain how you identified a material. ○ Communicate findings clearly using scientific vocabulary. ● Planning and Conducting Investigations ○ Design experiments that safely mix two or more substances. ○ Follow step-by-step procedures to ensure consistency and safety. ● Making Observations ○ Use senses and tools to observe changes in color, temperature, texture, bubbles, or smell. ○ Record observations with accuracy and detail. ● Collecting and Recording Data ○ Use data tables, charts or diagrams to organize observations. ○ Measure temperature or volume changes if applicable. ● Analyzing Results

Unit 2 - Matter Properties		
Content Standards	**Critical Knowledge**	**Critical Skills**
	○ Constraints are the limits placed on the solution (e.g., materials available, time allowed, or cost budget). ● Importance of Planning ○ Clearly defining the problem, including criteria and constraints, is the first and most important step in the engineering design process. ● Engineering Design Process ○ The design process includes defining a problem, planning a solution, creating a prototype, testing, and improving. ● Fair Testing in Engineering ○ A fair test changes only one variable at a time while keeping all others constant. ○ Fair tests provide reliable data that helps engineers make decisions about improving designs. ● Variables ○ Independent variable: The one thing that is changed. ○ Dependent variable: What is measured as a result. ○ Controlled variables: Things that are kept the same to ensure a fair test. ● Failure Points ○ Failure points are parts of a prototype or model that do not work as intended, break, or cause the solution to fail.	○ Determine whether a new substance has been formed based on evidence. ○ Distinguish between changes in appearance and the creation of new materials. ● Constructing Explanations ○ Use observed evidence to explain whether a chemical change occurred. ○ Compare findings to known properties of the original substances. ● Communicating Findings ○ Present results and conclusions using scientific reasoning and vocabulary. ○ Use visuals (charts, models, or diagrams) to support explanations ● Identifying Needs and Wants ○ Observe and ask questions to identify a real-world problem that people need or want to solve. ● Defining the Problem Clearly ○ Describe the problem in specific terms. ○ Identify who is affected and why the problem matters. ● Setting Criteria and Constraints ○ Collaboratively decide what a successful solution must do (criteria). ○ Recognize and list limits such as time, materials, and cost (constraints). ● Communicating the Problem ○ Write or present a clear problem statement that includes the goal, criteria, and constraints.

Unit 2 - Matter Properties		
Content Standards	**Critical Knowledge**	**Critical Skills**
	○ Identifying failure points helps engineers understand what needs improvement. ● Engineering is Iterative ○ The engineering design process involves multiple rounds of testing and improving. ○ Failure is a normal and useful part of designing effective solutions.	● Analyzing Existing Solutions ○ Look at how others have solved similar problems and use that information to guide planning. ● Collaborating and Brainstorming ○ Work in teams to share ideas and ask clarifying questions. ○ Record and discuss multiple possible solutions before choosing one to develop ● Planning Fair Tests ○ Design investigations where only one variable changes at a time. ○ Identify and control all other variables to ensure valid results. ● Constructing and Testing Prototypes ○ Build working models base on a defined problem and design criteria. ○ Test prototypes under realistic conditions to see how well they perform. ● Identifying Failure Points ○ Observe and document what parts of the model fail or don't perform as expected. ○ Analyze results to determine why something didn't work. ● Recording and Analyzing Data ○ Collect data during testing (measurements, observations, results). ○ Use tables, charts, and diagrams to organize findings. ● Improving Designs

Unit 2 - Matter Properties		
Content Standards	**Critical Knowledge**	**Critical Skills**
		○ Use data and failure analysis to suggest specific improvements to the prototype. ○ Revise and retest to move closer to meeting the design goals. ● Collaborating and Communicating ○ Work in teams to test, evaluate, and brainstorm improvements. ○ Clearly present findings, test results, and design decisions.

Integrated Accommodations and Modifications		
Special Education Students	**English Language Learners**	**At Risk**
● Utilize modifications & accommodations delineated in the student's IEP ● Provide additional manipulatives to support instruction ● Allow for alternative strategies to solve algorithms or tasks ● Provide the steps needed to complete the task ● Model frequently ● Provide repetition and practice. ● Use visuals to demonstrate/model the processes ● Restate, reread, and clarify directions/questions ● Ask students to restate information, directions, and assignments. ● Provide a copy of class notes ● Distribute study guide for classroom tests. ● Provide preferential seating to be mutually determined by the student and teacher ● Provide extra textbooks for home.	WIDA Can Do Descriptors https://wida.wisc.edu/teach/can-do/descriptors ● Modify Assignments ● Use testing and portfolio assessment ● Utilize Native Language Translation (peer, online assistive technology, translation device, bilingual dictionary) ● Repeat, rephrase, paraphrase key concepts and directions ● Allow for extended time for assignment completion as needed ● Highlight key vocabulary ● Define essential vocabulary in context ● Use graphic organizers, visuals, manipulatives, and other concrete materials ● Use gestures, facial expressions, and body language ● Read aloud ● Build on what students already know and prior experience	● Pair visual prompts with verbal presentations ● Ask students to restate information, directions, and assignments. ● Provide repetition and practice ● Model skills /techniques to be mastered. ● Provide extended time to complete class work ● Provide a copy of class notes ● Provide preferential seating to be mutually determined by the student and teacher ● Allow the use of a computer to complete assignments. ● Establish expectations for correct spelling on assignments ● Provide extra textbooks for home. ● Provide Peer Support ● Increase one on one time

• Provide regular parent/ school communication • Allow extended time to complete assignment • Establish procedures for accommodations / modifications for assessments • Allow student to take/complete tests in an alternate setting as needed Appendix A: Special Education Accommodations and Modifications		

Gifted and Talented Students	**504 Plan**
• Utilize advanced, accelerated, or compacted content • Provide assignments that emphasize higher- level thinking skills. • Allow for individual student interest • Gear assignments to development in areas of affect, creativity, cognition, and research skills • Allow for a variety in types of resources • Provide problem-based assignments with planned scope and sequence • Utilize inquiry-based instruction • Adjust the pace of lessons • Utilize Choice Boards • Provide Problem-Based Learning • Establish flexible Grouping	• Pair visual prompts with verbal presentations • Ask students to restate information, directions, and assignments. • Provide repetition and practice • Model skills/techniques to be mastered. • Provide extended time to complete class work • Provide a copy of class notes • Break long assignments into smaller parts • Assist students in setting short-term goals • Allow for preferential seating to be mutually determined by the student and teacher • Provide extra textbooks for home. • Model and reinforce organizational systems (i.e. color-coding) • Write out homework assignments, check students' recording of assignments
Interdisciplinary Connections	**Computer Science and Design Thinking**
ELA Standards • SL.6.1. Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grade 6* topics, texts, and issues, building on others' ideas and expressing their own clearly. • L.6.6. Acquire and use accurately grade appropriate general academic and domain specific words and phrases; *gather vocabulary knowledge when considering a word or phrase important to comprehension or expression. * • W.6.10. Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences	**Computer Science and Design Thinking Practices** • Fostering an Inclusive Computing and Design Culture • Collaborating Around Computing and Design • Recognizing and Defining Computational Problems • Developing and Using Abstractions • Creating Computational Artifacts • Testing and Refining Computational Artifacts • Communicating About Computing and Design **Computer Science and Design Thinking Standards**

Mathematics Standards

- 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)
- 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)
- 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)

- 8.2.8.ED.3: Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch).
- 8.1.8.DA.1: Organize and transform data collected using computational tools to make it usable for a specific purpose.

Career Readiness, Life Literacies and Key Skills

Career Readiness, Life Literacies and Key Skills Practices

- Act as a responsible and contributing community member and employee.
- Attend to financial well-being.
- Consider the environmental, social and economic impacts of decisions.
- Demonstrate creativity and innovation.
- Utilize critical thinking to make sense of problems and persevere in solving them.
- Model integrity, ethical leadership and effective management.
- Plan education and career paths aligned to personal goals.
- Use technology to enhance productivity, increase collaboration and communicate effectively.
- Work productively in teams while using cultural/global competence.

Career Readiness, Life Literacies and Key Skills Standards

9.1 Personal Financial Literacy

- 9.1.8.CR.2: Compare various ways to give back through strengths, passions, goals, and other personal factors.
- 9.1.8.CP.1: Compare prices for the same goods or services.
- 9.1.8.CP.2: Analyze how spending habits affect one's ability to save.
- 9.1.8.CP.3: Explain the purpose of a credit score and credit record, the factors and impact of credit scores.
- 9.1.8.FP.3: Explain how self-regulation is important to managing money (e.g., delayed gratification, impulse buying, peer pressure, etc.).
- 9.1.8.FP.5: Determine how spending, investing, and using credit wisely contributes to financial well-being.

9.2 Career Awareness, Exploration, Preparation, and Training

- 9.2.8.CAP.1: Identify offerings such as high school and county career and technical school courses, apprenticeships, military programs, and dual enrollment courses that support career or occupational areas of interest.

- 9.2.8.CAP.2: Develop a plan that includes information about career areas of interest.
- 9.2.8.CAP.3: Explain how career choices, educational choices, skills, economic conditions, and personal behavior affect income.

9.4 Life Literacies and Key Skills

21st Century Skills

- 9.4.8.CI.1: Assess data gathered on varying perspectives on causes of climate change (e.g., crosscultural, gender-specific, generational), and determine how the data can best be used to design multiple potential solutions (6.SP.B.5)
- 9.4.8.GCA.2: Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a group goal.

Technology Integration

- 9.4.8.IML.3: Create a digital visualization that effectively communicates a data set using formatting techniques such as form, position, size, color, movement, and spatial grouping. (6.SP.B.4)
- 9.4.8.IML.4: Ask insightful questions to organize different types of data and create meaningful visualizations.
- 9.4.8.TL.3: Select appropriate tools to organize and present information digitally.

SEL Competencies

- **Self - Awareness**
- **Self - Management**
- **Social Awareness**
- **Responsible Decision Making**
- **Relationship Skills**

https://www.nj.gov/education/safety/wellness/selearning/index.shtml

Anchoring Phenomenon

How can we make water healthy for all living things?

Lesson 1: How can we tell if water is healthy or unhealthy?
Lesson 2: What else can we figure out about our water samples?
Lesson 3: How can we design filters to separate these materials out of the water?
Lesson 4: How can we develop and optimize our filters to separate unhealthy materials out of the water?
Lesson 5: How can we figure out more about unseen matter that can be in water?
Lesson 6: How can we figure out if any of this matter that could be unhealthy is in the water samples?
Lesson 7: How can we use what we figured out about our water samples to identify the cause of a rash?
Lesson 8: How can boiling help to remove unhealthy materials from the water samples?
Lesson 9: How can we remove unhealthy matter from water without boiling it?
Lesson 10: How do scientists remove matter that is making water unhealthy?
Lesson 11: How can adding a substance make the water healthier?
Lesson 12: What have we figured out about making water healthier for a variety of living things?

Lesson 13: What community water problems need solutions?
Lesson 14: How can we use our design evaluations to rene our water solutions to better address the needs of our community?
Lesson 15: How can we use what we gured out about our water samples to create a healthy habitat for a turtle?

District/School Formative Assessment Plan	District/School Summative Assessment Plan
Formative assessment informs instruction and is ongoing throughout a unit to determine how students are progressing against the standards. Teachers are encouraged to incorporate Formative Assessments into all lessons. During instruction, teachers will collect ongoing information on students' mastery of content through a variety of methods: ● Questioning: using Socratic method, probing questions, a hierarchical system in complexity (Bloom's Taxonomy) ● Exit tickets, rotational activities (stations), quizzes, and small group activities ● Classwork, homework, group work (formative assessment) ● Pre-Assessment, teacher's observation, class discussion, and journal	**Final Model + Explanation of a Water Purification System** ● Students create a detailed diagram of an effective water purification system that combines multiple methods (e.g., filtering + boiling or solar still). ● Written explanation connects system parts to evidence from investigations. **Scenario-Based Argument from Evidence** ● Students receive a new water quality challenge (e.g., a community's well water has metallic particles + bacteria). ● Task: ○ Propose a solution. ○ Use data and evidence from the unit to justify their plan. **Performance Assessment: Engineering Design Challenge** ● Design, build, and refine a purification solution for a provided sample (e.g., metallic water or dirty rainwater). ● Use iterative testing, data recording, and refinement. ● Rubric focuses on: ○ Evidence-based design choices. ○ Clear explanation of how each part helps purify water. ○ Use of scientific reasoning. **Data Analysis Task** ● Provide students with second-hand data (e.g., graphs of contaminant levels before and after boiling or filtration). ● Students interpret data and explain what the data show about water quality changes.

Focus Scientific Concepts

Targeted Academic Vocabulary

Water Quality – A measure of the condition of water and its suitability for living organisms and human use.

Contaminant – Any substance that makes water unsafe or unhealthy, such as dirt, chemicals, or bacteria.

Filter – A device or material used to remove visible particles and some impurities from water.

Purification – The process of removing contaminants from water to make it cleaner and safer.

Boiling – A method of heating water to kill some harmful organisms and remove certain impurities.

Solar Still – A device that uses sunlight to evaporate water and then condense it, leaving contaminants behind.

Physical Properties – Observable characteristics of water, such as color, smell, temperature, or clarity.

Pollutant – A harmful material introduced into the environment, including water, that negatively affects ecosystems.

Model – A representation (diagram, physical build, or digital simulation) used to explain how systems or processes work.

Data – Information collected through observation or experimentation to help make conclusions or decisions.

Second-hand Data – Data collected by others, used to analyze or support scientific reasoning.

Water Treatment – A process or series of processes used to clean water and make it safe for use.

Engineering Design – A method for solving problems by designing, testing, and improving solutions.

Natural Water System – Water sources such as lakes, rivers, and rain that occur naturally in the environment.

Human-made Water System – Water systems created or altered by people, such as pools, pipes, and treatment plants.

District/School Primary and Supplementary Resources

Primary:

Hands-On Investigation Materials

Water Sample Kits

- Collected or teacher-prepared samples of:
  - Lake water (or pond/stream water)
  - Pool water (or tap water with added chlorine drops)

- Metallic water (tap water with safe dissolved iron filings or nails)
- Rainwater (or distilled water for simulation)

Observation Tools
- Clear containers (jars, beakers, or plastic cups)
- Hand lenses or magnifying glasses
- Droppers/pipettes
- Rulers (for measuring sediment layers)

Filter Design Supplies
- Sand, gravel, cotton balls, coffee filters, activated charcoal (if safe for classroom use)
- Plastic bottles (cut into funnels), rubber bands
- Cheesecloth or mesh

Boiling + Solar Still Equipment (for demos + small group trials)
- Heat-safe containers + access to safe heat source (teacher-led boiling demo)
- Clear plastic wrap, small rocks, bowls (for solar still setup)

Water Quality Test Strips (if available and safe)
- pH
- Chlorine
- Hardness / iron

Primary Data Sources
Student-Generated Data
- Observations of water properties (color, smell, clarity)
- Filter performance (e.g., time to filter, appearance of output water)
- Boiling or solar still results (amount of water collected, appearance, taste if appropriate/safe)
- Measurements (sediment depth, time taken for filtering/boiling/evaporation)

Supplementary:
Multimedia + Informational Texts
Articles + Short Texts
- *How Do Water Filters Work?* (kid-friendly science article)
- *Water Treatment Plants: Keeping Water Clean for Communities*
- *Water Scarcity Around the World* (connections to global issues)

Videos

- *How Water Gets Cleaned: A Tour of a Water Treatment Plant* (available via PBS LearningMedia or YouTube EDU)
- *The Journey of a Water Droplet* (animated explanation of the water cycle and purification)
- *Engineering Clean Water* (short documentary clips on innovations in water purification)

Cultural + Real-World Context Resources

Case Study Readings / Slide Decks

- *Flint, Michigan and Drinking Water Safety*
- *Traditional Water Stewardship Practices* (e.g., Navajo, Māori, or Andean communities)
- *Engineering Solutions in Developing Countries* (e.g., simple solar stills or sand filters used in rural areas)

Virtual Field Trips / 360° Tours

- Interactive virtual tour of a municipal water treatment plant
- Wetland ecosystems and their role in natural water filtration

Engineering Design + Data Resources

Second-Hand Data Sets

- Real pH / contaminant data from public water systems (OpenSciEd often uses these for authentic sensemaking)
- Charts or graphs showing solar still output under different conditions
- Comparative data on the effectiveness of boiling, filtering, and stills

Digital Simulations / Interactive Tools

- Water cycle + filtration interactive (e.g., PhET or other free online tools)
- *Design a Water Filter* virtual challenge (students choose materials and test combinations)

Sensemaking + Discussion Supports

Driving Question Board Templates (digital or printable)

- For students to document evolving questions and findings
- Anchor charts for tracking water quality concepts (e.g., pollutants, treatment methods)

Graphic Organizers / Visual Aids

- Flowchart templates for modeling water purification processes
- Cause-and-effect maps for linking human activities to water quality

Driving Question Board Reflections

- Students regularly revisit their *driving questions* about water quality (e.g., *"What makes water healthy or unhealthy for living things?"*).
- Assess changes in student ideas over time as they gather new evidence.
- Teacher uses observation notes or sticky-note tracking for individual contributions.

Model Revisions (Individual + Group)

- Students create initial models showing what affects water quality and how water might be purified.
- After each investigation (e.g., filter testing, boiling, solar stills), students revise models.
- Rubric assesses:
  - Inclusion of key factors (e.g., contaminants, purification steps).
  - Accuracy of matter flow (e.g., how contaminants are removed).
  - Use of evidence to justify revisions.

Science Notebook Prompts

- Written explanations supported by evidence after hands-on activities. Example prompts:
  - *"How did our filter change the water sample? What evidence do we have?"*
  - *"What does the data from boiling experiments tell us about purification?"*

Exit Slips / Quick Writes

- Short reflections:
  - *"One thing I learned about water purification today…"*
  - *"One question I still have about making water safe…"*

Instructional Best Practices and Exemplars

See Appendix B for Instructional Best Practices and Exemplars

Pacing Guide

Grade 5 Pacing Guide

Unit 3 - Earth and Sun

Overview

The Earth and Sun unit provides students with experiences to explore the properties of the atmosphere, energy transfer from the Sun to Earth, and the dynamics of weather and water cycling in Earth's atmosphere.

Essential Questions	Enduring Understandings
● How can we predict events based on shadows? ● What do shadows tell us about daily patterns involving the Earth/sun system? ● How and why does your shadow change during the day? ● What is the relationship between the position of the Sun and the length and direction of shadows? What causes day and night?	● Shadows change during the day because the position of the Sun changes in the sky. ● The length and direction of a shadow depends on the Sun's position in the sky. ● Day is the half of Earth's surface being illuminated by sunlight; night is the half of Earth's surface in its own shadow. ● The cyclical change between day and night is the result of Earth's

• What objects do we observe in our solar system and how do they move in relation to each other? • What do we see outside our system? • How can you explain why we see some natural objects only in the night sky, some only in the day sky, and some at both times? • How would you describe the size of and distance between Earth, the Moon, and the Sun? • Why does the shape of the Moon appear to change? • How do the parts of the solar system interact? • Why do stars appear to move across the night sky? • What is Earth's atmosphere and what does it have to do with weather? • What is air? • What is Earth's atmosphere? • How do meteorologists measure and record weather variables? • How does Earth's atmosphere heat up? • What is the effect of sunlight on earth materials? • How does energy transfer to the air? • How is water distributed over Earth's surface and atmosphere, how does it move, and what is the effect on Earth? • What causes condensation to form? • How does water vapor get into the air? • What is the water cycle? • What is the difference between weather and climate?	rotating around the stationary Sun, Earth's star. • The solar system includes the Sun, a star, and the objects that orbit it, including Earth, the Moon, seven other planets, their satellites, and smaller objects. • Gravity is a pulling force between two masses; it is the force that pulls things toward the center of Earth. • The pulling force of gravity keeps the planets and other objects in orbit by continuously changing their direction of travel. • A great deal of light travels through space to Earth from the Sun and from distant stars. • Stars are at different distances from Earth. The Sun is the closest star to Earth, so it appears brighter and larger. • The side of Earth facing the Sun is always in daylight; the side facing away from the Sun is always in darkness. • Air is a mixture of gases held by gravity near Earth's surface. Air is made of particles too small to see. Air has mass, takes up space, and is compressible. • Most of Earth's air resides in the troposphere, the layer of the atmosphere closest to Earth's surface. • Weather is the condition of Earth's atmosphere at a given time in a given place. • Meteorology is the science of weather, and meteorologists are the scientists who study Earth's weather. • Weather is described in terms of several variables. • The Sun is the major source of energy that heats Earth. • The different energy-transferring properties of earth materials (soil and water) can lead to uneven heating of Earth's surface. • The atmosphere is heated by conduction between Earth's surfaces and air particles as a result of contact, and by absorption of energy radiated directly from the Sun and re-radiated from Earth's surfaces. • Convection is the circulation of fluid (liquid or gas) that results in energy transfer. Convection currents are driven by uneven heating of Earth's surface. • A solar water heater is a system that uses solar energy to heat water. • People can protect Earth's resources and environments by using alternative energy sources. • Evaporation and condensation contribute to the movement of water through the water cycle, redistributing water over Earth's surface. • As temperature increases, the rate of evaporation increases. • Most of Earth's water (97%) is salt water in the ocean; Earth's fresh water is found in the atmosphere, lakes and rivers, soil, ground ice, ground water, and glaciers. The Sun's energy drives weather.

	• Climate is the average or typical weather that can be expected to occur in a region of Earth's surface. Earth's climate is changing.

Unit 3 - Earth Systems		
Content Standards	**Critical Knowledge**	**Critical Skills**
• **5-PS1-1** - Develop a model to describe that matter is made of particles too small to be seen. • **5-PS2-1 -** Support an argument that the gravitational force exerted by Earth on objects is directed down. • **5-ESS1-1 -** Support an argument that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from Earth. • **5-ESS1-2 -** Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night sky. • **5-ESS2-1 -** Develop a model using an example to describe the geosphere, biosphere, hydrosphere, and/or atmosphere. • **5-ESS2-2 -** Develop a model using an example to describe the geosphere, biosphere, hydrosphere, and/or atmosphere. • **5-ESS3-1 -** Describe and graph the amounts of salt water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth. • **3-5-ETS1-1 -** Obtain and combine information about ways individual communities use science	**Critical Knowledge for The Earth and Sun Unit** **Atmosphere** • The atmosphere is a layer of gases surrounding Earth, made up mostly of nitrogen and oxygen. • The atmosphere has different layers (e.g., troposphere, stratosphere) where weather occurs primarily in the troposphere. • Air pressure and temperature change with altitude in the atmosphere. **Energy Transfer from the Sun** • The Sun is the main source of energy for Earth's systems. • Solar energy reaches Earth and warms the land, air, and water. • Energy from the Sun drives winds, ocean currents, and the water cycle. • Heat moves through Earth's systems by radiation (from the Sun), conduction (through solids), and convection (through fluids like air and water). **Weather Dynamics** • Weather describes conditions like temperature, precipitation, wind, and humidity at a specific place and time. • Changes in air pressure and temperature cause wind and weather patterns. • The Sun's energy creates uneven heating of Earth's surface, which leads to local and	**Critical Skills for The Earth and Sun Unit** **Scientific Observation & Data Collection** • Observe and record weather conditions using tools such as thermometers, barometers, rain gauges, and anemometers. • Collect and organize data about temperature, precipitation, wind, and cloud types over time. **Modeling & Visual Representation** • Develop and use models to show energy transfer from the Sun to Earth's surface (e.g., diagrams, physical models). • Create diagrams to illustrate the water cycle and layers of the atmosphere. **Pattern Recognition & Data Analysis** • Analyze weather data to identify patterns over days, weeks, or seasons. • Compare data sets to recognize relationships between Sun energy, temperature, and weather changes. **Cause-and-Effect Reasoning** • Explain how uneven heating of Earth's surface by the Sun causes wind and weather patterns. • Describe how the Sun's energy drives the water cycle (evaporation, condensation, precipitation). **Use of Evidence to Support Explanations**

Unit 3 - Earth Systems		
Content Standards	**Critical Knowledge**	**Critical Skills**
ideas to protect the Earth's resources, environment, and address climate change issues. ● **3-5-ETS1-2 -** 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-ETS1-3 -** 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.	global wind patterns. **Water Cycle** ● The water cycle moves water through evaporation, condensation, precipitation, and collection. ● The Sun provides the energy that powers the water cycle. ● Clouds form when water vapor cools and condenses into tiny water droplets. ● Precipitation returns water to Earth's surface where it collects in bodies of water or soaks into the ground. **Relationships and Patterns** ● The Sun's energy causes daily and seasonal weather patterns. ● The tilt of Earth's axis and its orbit around the Sun result in seasons. ● Weather patterns can be observed, measured, and used to make predictions. **Scientific Tools and Data** ● Weather tools (e.g., thermometer, barometer, anemometer, rain gauge) are used to measure atmospheric conditions. ● Weather data can be recorded, graphed, and analyzed to identify trends and make forecasts.	● Use collected data and models to support claims about how the Sun affects Earth's atmosphere and weather. ● Explain weather events (e.g., storms, droughts) using scientific evidence. **Scientific Communication** ● Use scientific vocabulary (e.g., atmosphere, evaporation, condensation, radiation, convection) accurately in speaking and writing. ● Present findings using charts, graphs, written reports, and oral presentations. **Inquiry & Investigation** ● Ask testable questions about how energy from the Sun affects weather and the water cycle. ● Plan and conduct simple investigations (e.g., comparing how different surfaces heat up in sunlight). **Collaboration & Reflection** ● Work effectively in teams to collect and interpret data. ● Reflect on how scientific understanding of Earth-Sun interactions helps people prepare for and respond to weather events.

Integrated Accommodations and Modifications		
Special Education Students	**English Language Learners**	**At Risk**
● Utilize modifications & accommodations delineated in the student's IEP	WIDA Can Do Descriptors https://wida.wisc.edu/teach/can-do/descriptors	● Pair visual prompts with verbal presentations

• Provide additional manipulatives to support instruction • Allow for alternative strategies to solve algorithms or tasks • Provide the steps needed to complete the task • Model frequently • Provide repetition and practice. • Use visuals to demonstrate/model the processes • Restate, reread, and clarify directions/questions • Ask students to restate information, directions, and assignments. • Provide a copy of class notes • Distribute study guide for classroom tests. • Provide preferential seating to be mutually determined by the student and teacher • Provide extra textbooks for home. • Provide regular parent/ school communication • Allow extended time to complete assignment • Establish procedures for accommodations / modifications for assessments • Allow student to take/complete tests in an alternate setting as needed Appendix A: Special Education Accommodations and Modifications	• Modify Assignments • Use testing and portfolio assessment • Utilize Native Language Translation (peer, online assistive technology, translation device, bilingual dictionary) • Repeat, rephrase, paraphrase key concepts and directions • Allow for extended time for assignment completion as needed • Highlight key vocabulary • Define essential vocabulary in context • Use graphic organizers, visuals, manipulatives, and other concrete materials • Use gestures, facial expressions, and body language • Read aloud • Build on what students already know and prior experience	• Ask students to restate information, directions, and assignments. • Provide repetition and practice • Model skills /techniques to be mastered. • Provide extended time to complete class work • Provide a copy of class notes • Provide preferential seating to be mutually determined by the student and teacher • Allow the use of a computer to complete assignments. • Establish expectations for correct spelling on assignments • Provide extra textbooks for home. • Provide Peer Support • Increase one on one time

Gifted and Talented Students	504 Plan
• Utilize advanced, accelerated, or compacted content • Provide assignments that emphasize higher- level thinking skills. • Allow for individual student interest • Gear assignments to development in areas of affect, creativity, cognition, and research skills • Allow for a variety in types of resources • Provide problem-based assignments with planned scope and sequence	• Pair visual prompts with verbal presentations • Ask students to restate information, directions, and assignments. • Provide repetition and practice • Model skills/techniques to be mastered. • Provide extended time to complete class work • Provide a copy of class notes • Break long assignments into smaller parts

• Utilize inquiry-based instruction • Adjust the pace of lessons • Utilize Choice Boards • Provide Problem-Based Learning • Establish flexible Grouping	• Assist students in setting short-term goals • Allow for preferential seating to be mutually determined by the student and teacher • Provide extra textbooks for home. • Model and reinforce organizational systems (i.e. color-coding) • Write out homework assignments, check students' recording of assignments
Interdisciplinary Connections	**Computer Science and Design Thinking**
ELA Standards • SL.6.1. Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grade 6* topics, texts, and issues, building on others' ideas and expressing their own clearly. • L.6.6. Acquire and use accurately grade appropriate general academic and domain specific words and phrases; *gather vocabulary knowledge when considering a word or phrase important to comprehension or expression. * • W.6.10. Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences **Mathematics Standards** • 5.MD.B.2 - Make a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). Use operations on fractions for this grade to solve problems involving information presented in line plots. • 5.MD.A.1 - Convert among different-sized standard measurement units within a given measurement system and use these conversions in solving multi-step, real-world problems. • 5.OA.B.3 - Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns and graph the ordered pairs on a coordinate plane. • 5.NF.B.6 - Solve real-world problems involving multiplication of fractions and mixed numbers. • 5.NF.B.7 - Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions.	**Computer Science and Design Thinking Practices** • Fostering an Inclusive Computing and Design Culture • Collaborating Around Computing and Design • Recognizing and Defining Computational Problems • Developing and Using Abstractions • Creating Computational Artifacts • Testing and Refining Computational Artifacts • Communicating About Computing and Design **Computer Science and Design Thinking Standards** • 8.2.8.ED.3: Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch). • 8.1.8.DA.1: Organize and transform data collected using computational tools to make it usable for a specific purpose.

● 5.G.A.1 - Use a pair of perpendicular number lines (coordinate system) to graph points in the first quadrant of the coordinate plane. ● 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.	

Career Readiness, Life Literacies and Key Skills

Career Readiness, Life Literacies and Key Skills Practices

- Act as a responsible and contributing community member and employee.
- Attend to financial well-being.
- Consider the environmental, social and economic impacts of decisions.
- Demonstrate creativity and innovation.
- Utilize critical thinking to make sense of problems and persevere in solving them.
- Model integrity, ethical leadership and effective management.
- Plan education and career paths aligned to personal goals.
- Use technology to enhance productivity, increase collaboration and communicate effectively.
- Work productively in teams while using cultural/global competence.

Career Readiness, Life Literacies and Key Skills Standards

9.1 Personal Financial Literacy

- 9.1.8.CR.2: Compare various ways to give back through strengths, passions, goals, and other personal factors.
- 9.1.8.CP.1: Compare prices for the same goods or services.
- 9.1.8.CP.2: Analyze how spending habits affect one's ability to save.
- 9.1.8.CP.3: Explain the purpose of a credit score and credit record, the factors and impact of credit scores.
- 9.1.8.FP.3: Explain how self-regulation is important to managing money (e.g., delayed gratification, impulse buying, peer pressure, etc.).
- 9.1.8.FP.5: Determine how spending, investing, and using credit wisely contributes to financial well-being.

9.2 Career Awareness, Exploration, Preparation, and Training

- 9.2.8.CAP.1: Identify offerings such as high school and county career and technical school courses, apprenticeships, military programs, and dual enrollment courses that support career or occupational areas of interest.
- 9.2.8.CAP.2: Develop a plan that includes information about career areas of interest.
- 9.2.8.CAP.3: Explain how career choices, educational choices, skills, economic conditions, and personal behavior affect income.

9.4 Life Literacies and Key Skills

21st Century Skills

- 9.4.8.CI.1: Assess data gathered on varying perspectives on causes of climate change (e.g., crosscultural, gender-specific, generational), and determine how the data can best be used to design multiple potential solutions (6.SP.B.5)
- 9.4.8.GCA.2: Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a group goal.

Technology Integration

- 9.4.8.IML.3: Create a digital visualization that effectively communicates a data set using formatting techniques such as form, position, size, color, movement, and spatial grouping. (6.SP.B.4)
- 9.4.8.IML.4: Ask insightful questions to organize different types of data and create meaningful visualizations.
- 9.4.8.TL.3: Select appropriate tools to organize and present information digitally.

SEL Competencies

- **Self - Awareness**
- **Self - Management**
- **Social Awareness**
- **Responsible Decision Making**
- **Relationship Skills**

https://www.nj.gov/education/safety/wellness/selearning/index.shtml

Anchoring Phenomenon

1. Time-Lapse of a Playground Shadow Changing Throughout the Day
2. Video of a Sundial Accurately Telling Time
3. A Spinning Globe Lit by a Flashlight in a Dark Room
4. Photographs of the Moon Over a Month Showing Different Shapes
5. Simulation of the Solar System Showing Orbits
6. Star Trails Captured in a Time-Lapse Photo
7. Diagram Comparing Day and Night Skies with Visible Celestial Objects
8. Model of Relative Size and Distance of Earth, Moon, and Sun Using Common Objects
9. Condensation Forming on a Cold Glass
10. Real Weather Forecast Video with Meteorologist Using Instruments
11. Infrared Video Showing How Sunlight Heats Different Earth Materials
12. Animation Showing the Water Cycle in Action
13. Time-lapse of a Storm System or Cloud Formation Over Time
14. World Map Showing Climate Zones vs. Daily Weather Conditions in Two Cities
15. Clear Bottle Model Showing “Invisible” Air Pressure and Movement

District/School Formative Assessment Plan	District/School Summative Assessment Plan
Formative assessment informs instruction and is ongoing throughout a unit to determine how students are progressing against the standards. Teachers are encouraged to incorporate Formative Assessments into all lessons. During instruction, teachers will collect ongoing information on students’ mastery of content through a variety of methods:	**Unit assessment** **Other Summative Assessments:** Teachers are encouraged to design and implement their own assessments (topic/module tests and quizzes) individually and/or with their department or grade-level partners, as per

• Questioning: using Socratic method, probing questions, a hierarchical system in complexity (Bloom's Taxonomy) • Exit tickets, rotational activities (stations), quizzes, and small group activities • Classwork, homework, group work (formative assessment) • Pre-Assessment, teacher's observation, class discussion, and journal	Uniform Grading Profile. **Examples:** • Observational Checklist • Student Drawings • Journal Entry / Class Chart • Ongoing Observation Log • Performance Task

Focus Scientific Concepts

Targeted Academic Vocabulary

Atmosphere — The blanket of gases that surrounds Earth and supports life.

Energy — The ability to cause change or do work; the Sun provides Earth with energy in the form of light and heat.

Energy transfer — The movement of energy from one place or object to another, such as the Sun's energy warming Earth's surface.

Solar energy — Energy that comes from the Sun and powers many processes on Earth, including weather and the water cycle.

Radiation — Energy that travels in waves through space, like sunlight reaching Earth.

Conduction — The transfer of heat energy when two objects touch.

Convection — The transfer of heat energy through liquids or gases, where warmer parts rise and cooler parts sink.

Weather — The daily conditions of the air, including temperature, wind, clouds, and precipitation.

Water cycle — The continuous movement of water through evaporation, condensation, precipitation, and collection.

Evaporation — The process where liquid water changes into water vapor (gas), usually because of heat from the Sun.

Condensation — The process where water vapor cools and turns back into liquid water, forming clouds.

Precipitation — Water that falls from clouds as rain, snow, sleet, or hail.

Wind — Moving air caused by differences in temperature and air pressure.

Temperature — A measure of how hot or cold something is.

Clouds — Groups of tiny water droplets or ice crystals that float in the atmosphere.

Air pressure — The force of air pushing down on Earth, which helps create weather patterns.

District/School Primary and Supplementary Resources

Primary:

Hands-On Investigation Materials

Solar Radiation Tools

- Infrared temperature sensors or simple thermometers to measure surface heating
- Light sensors or UV beads to track sunlight intensity
- Black and white paper or materials to explore absorption/reflection

Water Cycle Exploration

- Clear containers for modeling evaporation and condensation
- Ice, warm water, and plastic wrap for simple condensation experiments
- Sponges, mist bottles, and trays for simulating precipitation

Atmosphere and Air Properties

- Balloons or syringes to explore air pressure
- Sealed jars or bags for showing air volume/compression
- Wind vanes, anemometers (store-bought or DIY straws + pinwheels)

Data Collection Tools

Weather Journals / Logs

- Templates for students to record daily temperature, wind, cloud cover, and humidity (using basic tools like outdoor thermometers and cloud charts)

Real-Time Weather Data

- Local weather station reports or school-installed weather sensors (for students to gather authentic data on temperature, wind, precipitation)

Sun Tracking

- Shadows on a sundial or stick + paper plate setup to track Sun's movement during the day

Primary Source Media

Satellite Images / Weather Maps (Primary Data)

- NASA's *Earth Observatory* or *GOES* satellite imagery for cloud cover, storm tracking
- NOAA weather maps showing fronts and atmospheric patterns

Videos of Natural Phenomena
- Timelapse videos of cloud formation, storms, or the water cycle (used as primary visual data for analysis)

Student-Generated Primary Resources
Student Models
- Physical models of Earth-Sun system (foam ball Earth, lamp Sun) to study energy transfer
- Water cycle in a bag or jar as primary model for condensation/evaporation

Observation-Based Drawings and Diagrams
- Cloud type sketches
- Sun's angle at different times of day
- Weather pattern maps from local observations

Supplementary:
Informational Texts + Articles
- *What Happens to the Sun's Energy on Earth?* (kid-friendly science article explaining absorption, reflection, and re-radiation)
- *The Water Cycle in Action* (short reading with diagrams showing evaporation, condensation, precipitation, and collection
- *How Weather Works* (overview of air masses, fronts, and storms written for upper elementary students)

Videos + Animations
NASA SciJinks or NOAA Weather Education Animations
- *How Does the Sun Affect Weather?*
- *What Causes Wind?*
- *The Water Cycle Explained*

Virtual Tours
- Interactive exploration of Earth from space (e.g., NASA Earth Now app, Google Earth weather layers)
- Tour of a weather station or observatory

Data + Second-Hand Evidence
Weather Data Sets
- Temperature, humidity, wind speed, and precipitation data from local or national weather services
- Solar radiation levels across different regions (great for graphing + comparing)

Satellite Images and Maps
- Cloud movement sequences from NOAA or NASA
- Weather front animations (OpenSciEd loves using these as secondary data for sensemaking)

Digital Simulations + Interactive Tools

PhET Interactive Simulations (free)

- *Energy Forms and Changes* (explore transfer of solar energy)
- *Clouds and Precipitation* (if available through partner platforms)

Online Weather Tools

- Local weather radar + forecast sites
- Interactive water cycle models (e.g., from USGS or SciJinks)

Cultural + Real-World Context Resources

- *Traditional Weather Knowledge* — short readings or videos about how Indigenous communities observe and interpret patterns in the Sun, clouds, and winds
- *Solar Energy in Action* — case studies or brief articles on solar cookers, solar houses, or farms using solar panels

Sensemaking Aids

- Driving Question Board templates for tracking big questions like: *How does energy from the Sun power Earth's systems?*
- Graphic organizers for modeling:
  - The water cycle
  - Energy flow from Sun to Earth and atmosphere

Instructional Best Practices and Exemplars
See Appendix B for Instructional Best Practices and Exemplars

Pacing Guide
Grade 5 Pacing Guide

Unit 4 - Earth and Sun	
Overview	
Unit 4 begins with In this unit, students explore the patterns created by Earth's movement in space and its relationship to the Sun and stars. They investigate daily and seasonal changes in the sky, including the apparent motion of the Sun, the visibility of stars, and the causes of seasons. Students also learn how distance affects the size and brightness of celestial objects as seen from Earth. Through observations, models, and data analysis, students build an understanding of the predictable patterns in the sky and how these patterns impact life on Earth.	
Essential Questions	**Enduring Understandings**
• What patterns can we observe in the sky each day and throughout the year?	• **Earth's movement in space causes predictable patterns -** Earth's rotation creates the cycle of day and night, while Earth's tilt and revolution around

• How does Earth's movement in space create the cycles of day, night, and seasons? • Why do we see different stars at different times of the year? • How does distance affect how big and bright objects in the sky appear to us? • How do the Sun, Earth, and stars work together to create patterns we can predict? • How do these sky patterns affect life on Earth?	the Sun cause the seasons and the changing positions of stars throughout the year. • **The Sun, stars, and Earth interact to create patterns we can observe -** The apparent motion of the Sun and stars across the sky follows regular patterns that can be predicted based on Earth's position in space. • **The visibility and appearance of celestial objects depend on distance.** The size and brightness of objects like the Sun and stars appear different to us because of how far away they are. • **Observing and modeling sky patterns helps us understand and predict changes -** By making observations and using models, we can explain and predict changes in the sky and how they affect life on Earth (e.g., seasons, length of day). • **The Sun's position and star patterns change in ways that impact life on Earth -** The patterns caused by Earth's movements affect temperature, daylight hours, and what constellations we see in the night sky.

Unit 4 - Earth and Sun		
Content Standards	**Critical Knowledge**	**Critical Skills**
• **5-PS2-1 -** Support an argument that the gravitational force exerted by Earth on objects is directed down. • **5-ESS1-1 -** Support an argument that differences in the apparent brightness of the sun compared to other stars are due to their relative distances from Earth. • **5-ESS1-2 -** Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.	**Critical Knowledge for Earth, Sun, and Stars:** **Patterns in the Sky** **Daily and Yearly Sky Patterns** • Earth's rotation on its axis causes the cycle of day and night and makes the Sun and stars appear to move across the sky each day. • Earth revolves around the Sun once each year, creating patterns in what we see in the sky over months and seasons. • The length of daylight and the Sun's position in the sky change in regular ways throughout the year. **Earth's Movement and Seasons** • Earth's axis is tilted at about 23.5 degrees.	**Critical Skills** • Observe and record daily and seasonal changes in the sky, such as the position of the Sun or visibility of constellations. • Identify patterns in daylight length, Sun position, and star visibility over time. • Use data (e.g., sunrise/sunset times) to recognize and explain sky patterns. • Construct models to show how Earth's rotation causes day and night.

Unit 4 - Earth and Sun		
Content Standards	**Critical Knowledge**	**Critical Skills**
	● The combination of Earth's tilt and its revolution around the Sun causes the seasons. ● The Sun appears higher in the sky during summer and lower in the sky during winter, affecting temperature and daylight hours. **Star Visibility and Patterns** ● Different stars and constellations are visible at different times of the year because of Earth's position in its orbit around the Sun. ● The apparent movement of stars at night is caused by Earth's rotation. **Distance and Appearance of Celestial Objects** ● The Sun appears larger and brighter than other stars because it is much closer to Earth. ● The size and brightness of objects in the sky depend on their actual size and their distance from Earth. **Predictable Patterns** ● The positions of the Sun, stars, and constellations follow predictable patterns that can be observed, modeled, and used to make forecasts (e.g., sunrise/sunset times, star visibility). ● These patterns have been used by people for centuries to track time, create calendars, and guide navigation. **Impact on Life on Earth** ● The patterns caused by Earth's movements affect temperatures, seasons, growing cycles for plants, animal behaviors (like migration), and human activities.	● Create diagrams or simulations of Earth's tilt and revolution to explain seasonal changes. ● Use models to demonstrate how the apparent motion of stars is caused by Earth's movement. ● Explain cause-and-effect relationships, such as how Earth's tilt causes seasons or how rotation leads to day/night. ● Infer the reason for seasonal temperature and daylight differences by combining knowledge of Earth's tilt and orbit. ● Compare celestial objects by reasoning about their size, distance, and brightness (e.g., Sun vs. stars). ● Explain why the Sun appears larger and brighter than other stars even though it is not the largest. ● Use observed patterns to predict future sky events, such as the time of sunrise or when certain constellations will appear. ● Apply knowledge of Earth's motion to anticipate changes in daylight, seasons, or star visibility. ● Connect sky patterns to life on Earth, such as changes in seasons, migration, plant cycles, and human activities.

Unit 4 - Earth and Sun		
Content Standards	**Critical Knowledge**	**Critical Skills**
	• Predictable sky patterns help people plan for changes in daylight, temperature, and seasonal events.	• Explain how predictable patterns in the sky have been used for timekeeping, navigation, and agriculture. • Use evidence to explain observations and defend claims about the causes of sky patterns. • Communicate findings using scientific vocabulary (e.g., rotation, revolution, tilt, orbit, axis, constellation). • Collaborate with peers to discuss, revise, and present models or explanations.

Integrated Accommodations and Modifications		
Special Education Students	**English Language Learners**	**At Risk**
• Utilize modifications & accommodations delineated in the student's IEP • Provide additional manipulatives to support instruction • Allow for alternative strategies to solve algorithms or tasks • Provide the steps needed to complete the task • Model frequently • Provide repetition and practice. • Use visuals to demonstrate/model the processes • Restate, reread, and clarify directions/questions • Ask students to restate information, directions, and assignments. • Provide a copy of class notes • Distribute study guide for classroom tests.	WIDA Can Do Descriptors https://wida.wisc.edu/teach/can-do/descriptors • Modify Assignments • Use testing and portfolio assessment • Utilize Native Language Translation (peer, online assistive technology, translation device, bilingual dictionary) • Repeat, rephrase, paraphrase key concepts and directions • Allow for extended time for assignment completion as needed • Highlight key vocabulary • Define essential vocabulary in context • Use graphic organizers, visuals, manipulatives, and other concrete materials • Use gestures, facial expressions, and body language	• Pair visual prompts with verbal presentations • Ask students to restate information, directions, and assignments. • Provide repetition and practice • Model skills /techniques to be mastered. • Provide extended time to complete class work • Provide a copy of class notes • Provide preferential seating to be mutually determined by the student and teacher • Allow the use of a computer to complete assignments. • Establish expectations for correct spelling on assignments • Provide extra textbooks for home. • Provide Peer Support • Increase one on one time

• Provide preferential seating to be mutually determined by the student and teacher • Provide extra textbooks for home. • Provide regular parent/ school communication • Allow extended time to complete assignment • Establish procedures for accommodations / modifications for assessments • Allow student to take/complete tests in an alternate setting as needed Appendix A: Special Education Accommodations and Modifications	• Read aloud • Build on what students already know and prior experience	

Gifted and Talented Students	504 Plan
• Utilize advanced, accelerated, or compacted content • Provide assignments that emphasize higher- level thinking skills. • Allow for individual student interest • Gear assignments to development in areas of affect, creativity, cognition, and research skills • Allow for a variety in types of resources • Provide problem-based assignments with planned scope and sequence • Utilize inquiry-based instruction • Adjust the pace of lessons • Utilize Choice Boards • Provide Problem-Based Learning • Establish flexible Grouping	• Pair visual prompts with verbal presentations • Ask students to restate information, directions, and assignments. • Provide repetition and practice • Model skills/techniques to be mastered. • Provide extended time to complete class work • Provide a copy of class notes • Break long assignments into smaller parts • Assist students in setting short-term goals • Allow for preferential seating to be mutually determined by the student and teacher • Provide extra textbooks for home. • Model and reinforce organizational systems (i.e. color-coding) • Write out homework assignments, check students' recording of assignments

Interdisciplinary Connections	Computer Science and Design Thinking
ELA Standards • SL.6.1. Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grade 6* topics, texts, and issues, building on others' ideas and expressing their own clearly. • L.6.6. Acquire and use accurately grade appropriate general academic and domain specific words and phrases; *gather vocabulary knowledge	**Computer Science and Design Thinking Practices** • Fostering an Inclusive Computing and Design Culture • Collaborating Around Computing and Design • Recognizing and Defining Computational Problems • Developing and Using Abstractions • Creating Computational Artifacts • Testing and Refining Computational Artifacts • Communicating About Computing and Design

when considering a word or phrase important to comprehension or expression. *
- W.6.10. Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences

Mathematics Standards
- 5.MD.B.2 - Make a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). Use operations on fractions for this grade to solve problems involving information presented in line plots.
- 5.MD.A.1 - Convert among different-sized standard measurement units within a given measurement system and use these conversions in solving multi-step, real-world problems.
- 5.OA.B.3 - Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns, and graph the ordered pairs on a coordinate plane.
- 5.G.A.1 - Use a pair of perpendicular number lines (coordinate system), called axes, to define a coordinate system. Locate and plot points in the first quadrant.
- 5.G.A.2 - Graph real-world problems in the first quadrant of the coordinate plane and interpret coordinate values of points in context.
- 5.NF.B.6 - Solve real-world problems involving multiplication of fractions and mixed numbers.
- 5.NF.B.7 - Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions.

Computer Science and Design Thinking Standards
- 8.2.8.ED.3: Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch).
- 8.1.8.DA.1: Organize and transform data collected using computational tools to make it usable for a specific purpose.

Career Readiness, Life Literacies and Key Skills

Career Readiness, Life Literacies and Key Skills Practices

- Act as a responsible and contributing community member and employee.
- Attend to financial well-being.
- Consider the environmental, social and economic impacts of decisions.
- Demonstrate creativity and innovation.
- Utilize critical thinking to make sense of problems and persevere in solving them.
- Model integrity, ethical leadership and effective management.
- Plan education and career paths aligned to personal goals.
- Use technology to enhance productivity, increase collaboration and communicate effectively.
- Work productively in teams while using cultural/global competence.

Career Readiness, Life Literacies and Key Skills Standards

9.1 Personal Financial Literacy

- 9.1.8.CR.2: Compare various ways to give back through strengths, passions, goals, and other personal factors.
- 9.1.8.CP.1: Compare prices for the same goods or services.
- 9.1.8.CP.2: Analyze how spending habits affect one's ability to save.
- 9.1.8.CP.3: Explain the purpose of a credit score and credit record, the factors and impact of credit scores.
- 9.1.8.FP.3: Explain how self-regulation is important to managing money (e.g., delayed gratification, impulse buying, peer pressure, etc.).
- 9.1.8.FP.5: Determine how spending, investing, and using credit wisely contributes to financial well-being.

9.2 Career Awareness, Exploration, Preparation, and Training

- 9.2.8.CAP.1: Identify offerings such as high school and county career and technical school courses, apprenticeships, military programs, and dual enrollment courses that support career or occupational areas of interest.
- 9.2.8.CAP.2: Develop a plan that includes information about career areas of interest.
- 9.2.8.CAP.3: Explain how career choices, educational choices, skills, economic conditions, and personal behavior affect income.

9.4 Life Literacies and Key Skills

21st Century Skills

- 9.4.8.CI.1: Assess data gathered on varying perspectives on causes of climate change (e.g., crosscultural, gender-specific, generational), and determine how the data can best be used to design multiple potential solutions (6.SP.B.5)
- 9.4.8.GCA.2: Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a group goal.

Technology Integration

- 9.4.8.IML.3: Create a digital visualization that effectively communicates a data set using formatting techniques such as form, position, size, color, movement, and spatial grouping. (6.SP.B.4)
- 9.4.8.IML.4: Ask insightful questions to organize different types of data and create meaningful visualizations.
- 9.4.8.TL.3: Select appropriate tools to organize and present information digitally.

SEL Competencies

- **Self - Awareness**

- **Self - Management**
- **Social Awareness**
- **Responsible Decision Making**
- **Relationship Skills**

https://www.nj.gov/education/safety/wellness/selearning/index.shtml

Anchoring Phenomenon
1. Time-lapse videos showing the motion of the Sun across the sky throughout the day and the seasonal positions of sunrise and sunset over a year. ● Students notice predictable daily and annual sky patterns. 2. A globe with a tilted axis rotating under a fixed light source simulates how day/night and seasonal light variation occur. ● Students explore how rotation and axial tilt cause these cycles. 3. Star map overlays of the night sky taken from the same location at different seasons (e.g., Orion in winter, Scorpius in summer). ● Students investigate why constellations change over the year. 4. The Sun and Moon appear the same size in the sky, even though the Sun is vastly larger — leading to solar eclipses. ● Students explore apparent size and brightness due to distance. 5. Calendars and cultural traditions based on predictable celestial events (e.g., solstices, equinoxes, harvest festivals). ● Students connect astronomy to timekeeping and planning. 6. Circadian rhythms in humans and animals change with light exposure; examples include jet lag or seasonal affective disorder (SAD). ● Students link sky patterns to physiological responses in living organisms. 7. To strengthen the anatomy and physiology connection, consider framing investigations around: ● The human biological clock and light's effect on melatonin ● Vitamin D synthesis and its dependence on sunlight ● The effect of daylight cycles on sleep and alertness ● How seasonal changes influence animal behavior and physiology (e.g., migration, hibernation)

District/School Formative Assessment Plan	District/School Summative Assessment Plan
Formative assessment informs instruction and is ongoing throughout a unit to determine how students are progressing against the standards. Teachers are encouraged to incorporate Formative Assessments into all lessons. During instruction, teachers will collect ongoing information on students' mastery of content through a variety of methods: ● Questioning: using Socratic method, probing questions, a hierarchical system in complexity (Bloom's Taxonomy) ● Exit tickets, rotational activities (stations), quizzes, and small group activities	**Unit assessment** **Other Summative Assessments:** Teachers are encouraged to design and implement their own assessments (topic/module tests and quizzes) individually and/or with their department or grade-level partners, as per Uniform Grading Profile. **Examples:** ● Observational Checklist

• Classwork, homework, group work (formative assessment) • Pre-Assessment, teacher's observation, class discussion, and journal	• Student Drawings • Journal Entry / Class Chart • Ongoing Observation Log • Performance Task

Focus Scientific Concepts

Targeted Academic Vocabulary

Rotation - The spinning of Earth on its axis, causing day and night.

Revolution - The movement of Earth around the Sun, taking about one year.

Axis - The imaginary line that Earth spins around.

Tilt - The angle of Earth's axis (about 23.5°), which causes seasons.

Orbit - The path Earth follows as it revolves around the Sun.

Constellation - A group of stars that form a pattern in the night sky.

Apparent motion - How objects like the Sun and stars seem to move across the sky because of Earth's rotation and revolution.

Celestial object - Any object in space, such as the Sun, Moon, planets, and stars.

Daylight - The amount of time the Sun is above the horizon during the day.

Season - A time of year marked by specific weather patterns and daylight hours, caused by Earth's tilt and revolution.

Star - A huge ball of gas that gives off light; the Sun is our closest star.

Sun - The star at the center of our solar system that provides Earth with light and heat.

Distance - How far something is from Earth, affecting how big and bright it appears.

Pattern - Something that happens in a regular and predictable way.

Model - A drawing, diagram, or physical object that shows how something in space works.

Observation - Using your senses or tools to gather information about the world around you.

Data - Information collected during observations or experiments that can be analyzed.

District/School Primary and Supplementary Resources

Primary:

Hands-On Investigation Materials

Sun Tracking Tools

- Meter sticks or yardsticks for measuring shadow length
- Chalk or flags for marking shadow positions at different times
- Paper plates or cardboard circles for constructing simple sundials

Models of Earth-Sun-System

- Styrofoam balls, toothpicks, and lamps (to model Earth's tilt and orbit)
- Flashlights and small spheres (to explore size/brightness vs. distance)

Night Sky Observation Tools

- Star maps / planispheres for identifying constellations
- Simple binoculars (optional for enhanced viewing of bright stars)
- Journals for sketching moon phases and visible stars

Direct Observation + Data Collection

Shadow and Sun Path Observations

- Students measure shadow length/angle at regular intervals and record patterns over several days

Star and Constellation Tracking

- Students log star visibility at different times and dates, noting patterns

Seasonal Pattern Charts

- Students create and update charts showing changing sunrise/sunset times

Moon Phase Logs

- Nightly sketches or photos of the Moon over a month

Primary Source Media & Data

NASA Solar Dynamics Observatory (SDO) images

- Real-time images of the Sun's activity

NOAA Sunrise/Sunset tables

- Data on local sunrise/sunset times for analysis

Time-lapse videos of sky movement

- Primary visual data for modeling rotation and revolution

Stellarium (or similar sky simulator) screenshots

- Used as primary data source when direct observation isn't possible

Student-Generated Primary Artifacts

- Physical models of Earth-Sun relationships (showing tilt, orbit)
- Shadow tracking charts
- Star visibility logs by date/time
- Distance-brightness comparison charts from flashlight/sphere experiments

Supplementary:

Texts and Readings

Books & Articles

- *The Sun and the Moon* (Gail Gibbons) – accessible text on celestial patterns
- *Looking Through a Telescope* (Linda Bullock) – introduction to observing night sky objects
- NASA's *Solar System Exploration* student pages — clear, engaging summaries of Earth-Sun relationships

Mythology and Culture Connections

- Stories about constellations from Greek, Native American, and other cultures
- Readings on how ancient cultures used the Sun/stars for calendars

Digital Tools & Simulations

- **NASA Eyes on the Solar System** — 3D interactive model of Earth, Sun, and planets
- **PhET Simulation: *Solar System*** — interactive distance, size, brightness models

Videos

- *Crash Course Kids: The Sun and Earth*
- *NASA Space Place: What Causes the Seasons?*
- *Mystery Science: Why do stars change with the seasons?* (if your district uses it)

Enrichment Investigations

Citizen Science

- *Globe at Night*: contribute to a global database of star visibility and light pollution

DIY Star Wheels / Planispheres

- Printable tools to identify stars and constellations

NASA's *Spot the Station*

- Schedule ISS viewings and relate motion to Earth's rotation/orbit

Datasets for Analysis

- NOAA sun position charts (for graphing sunrise/sunset trends)
- NASA star brightness data for student analysis of distance/size relationships

Instructional Best Practices and Exemplars

See Appendix B for Instructional Best Practices and Exemplars

Pacing Guide

Grade 5 Pacing Guide

Appendix A

Accommodations and Modifications

Unit 1:

Accommodations

- Chunk instructions into step-by-step directions with visuals.
- Use sentence starters or frames for observations and explanations (e.g., "I noticed that…" or "The plant grew because…").
- Provide graphic organizers (e.g., flowcharts for matter cycling, cause-and-effect charts, compare/contrast tables).
- Allow extended time for experiments, journaling, and model construction.
- Highlight key vocabulary and provide a visual glossary (e.g., decomposer, energy, matter, system, fungus).
- Use color-coded labels or diagrams to help identify components in models and systems (e.g., producers, consumers, decomposers).
- Allow oral responses in place of written work when appropriate.
- Use visual aids, models, and real-life photos to support explanation of abstract concepts.
- Pair students for collaborative discussions and shared notetaking.
- Provide opportunities for students to act out processes (e.g., energy flow, food web dynamics).

- Use anchor charts to summarize each lesson's key phenomenon and learning.
- Provide pre-labeled diagrams or partially completed models for students to finish.
- Offer illustrated instructions for labs and building activities.
- Display "before" and "after" models to support understanding of decomposition and change over time.
- Use checklists or rubrics to guide science journal entries and reflections.
- Allow use of technology (e.g., speech-to-text or typing tools) for students with writing challenges.
- Offer fill-in-the-blank notes or scaffolded lab sheets.
- Use timers or visual schedules for tasks during investigations or multi-step activities.
- Break long tasks into manageable chunks with breaks in between.
- Give students roles in group work to provide structure (e.g., recorder, material manager, speaker).
- Pre-teach key vocabulary using visuals and native-language support if available.
- Use translated instructions or bilingual dictionaries where appropriate.
- Provide sentence stems for explanation tasks (e.g., "The moss helps because…").
- Model academic language through think-alouds and peer examples.
- Allow alternatives to sensory-heavy materials (e.g., gloves for students uncomfortable with soil or insects).
- Provide models or simulations (e.g., digital decomposition or plant growth tools) if real materials are unavailable or inaccessible.
- Offer choices for how students demonstrate understanding (e.g., drawing, building, verbal explanation).
- Allow multiple means of expression (verbal, visual, physical models, digital tools).
- Use project-based or performance assessments instead of traditional tests when appropriate.
- Give frequent, low-stakes checks for understanding (e.g., thumbs-up/down, exit tickets).

Modifications

- Simplify language in reading materials and instructions (e.g., use "rot" instead of "decompose," "food chain" instead of "energy system" when appropriate).
- Reduce vocabulary load by focusing on 3–5 essential terms per lesson.
- Pre-highlight important details in lab instructions or observations to focus student attention.
- Provide short texts or visuals instead of complex informational passages when researching organisms (e.g., moss, termites, mushrooms).
- Shorten assignments (e.g., fewer items to classify or label; draw one decomposer instead of three).
- Limit the number of variables in investigations (e.g., test plant growth with one factor instead of several).
- Reduce the number of steps in experiments or models while keeping core purpose intact.
- Use fill-in-the-blank models or sentence starters for explaining energy flow or matter changes (e.g., "The plant uses sunlight to ___.").
- Allow alternate formats for output (e.g., draw a single stage of decomposition rather than creating a full sequence; build a simplified model of a nurse log).
- Use pre-made diagrams for students to label or partially complete instead of designing from scratch.
- Reduce expectations for written explanation (e.g., 1–2 sentences instead of full paragraphs).
- Allow group or partner work for poster creation or model building to reduce individual demands.

- Provide step-by-step guided instruction for labs and models (e.g., teacher-led demonstrations before independent work).
- Use leveled questioning (e.g., "What do you notice?" instead of "Why does this happen?").
- Focus on observation and description rather than explanation for some students (e.g., "Describe what is happening to the log" rather than "Explain the energy cycle.").
- Provide partially completed graphic organizers for concepts like food webs, energy flow, or growth changes.
- Allow extended time for completing investigations, building models, or writing explanations.
- Break complex activities into smaller chunks (e.g., build the food web over two sessions instead of one).
- Use visual assessments (e.g., picture matching, sorting cards) instead of traditional quizzes.
- Grade based on essential concepts only (e.g., understanding that "plants need sunlight to grow" instead of explaining the full photosynthesis process).
- Use performance-based assessments (e.g., demonstrate understanding with manipulatives or models rather than writing).

Unit 2:

Accommodations

- Pre-teach key vocabulary using visuals and student-friendly definitions (e.g., "filter," "unhealthy," "bacteria," "boil").
- Provide guided notes or graphic organizers for each lesson to help organize claims, evidence, and reasoning.
- Use sentence starters and writing frames for explanations (e.g., "We think the water is unhealthy because…").
- Highlight key information in lab procedures and data tables to reduce cognitive load.
- Use diagrams, illustrations, and color coding to model processes (e.g., how filters work or how substances are removed).
- Provide physical models or simulations (e.g., clear containers to show water clarity, colored beads to represent particles).
- Use real-world photos or videos to reinforce abstract ideas (e.g., water treatment plants, healthy vs. unhealthy ecosystems).
- Assign roles in group work (e.g., data recorder, materials manager, reporter) to increase engagement and structure.
- Allow verbal responses or drawings instead of written ones when appropriate.
- Provide multiple means of demonstrating learning (oral explanations, labeled drawings, models, short video presentations).
- Allow extended time for investigations, model construction, and written explanations.
- Break complex tasks into smaller, manageable steps (e.g., design → build → test → revise filter).
- Provide visual schedules or checklists for multi-step labs or projects.
- Model investigation steps before independent practice (e.g., teacher demonstrates filter-building before student tries).
- Offer limited choices for materials/tools during design challenges to reduce decision-making burden.
- Provide sample data or simplified datasets for students to analyze if needed.
- Accept alternative formats (drawn models, voice recordings, slide decks) instead of formal written reports.
- Use pre-labeled diagrams or partially completed charts for students to complete or match.
- Pair verbal instructions with visuals and gestures.
- Encourage use of native language or translation tools to process new information before producing in English.
- Use partner discussions or think-pair-share to help students rehearse ideas before writing or presenting
- Connect water problems to local or familiar contexts (e.g., local streams, community gardens, pets).

- Incorporate student interests into final projects (e.g., designing water for a turtle habitat, designing posters for school).

Modifications

- Use visual supports (pictures of clear vs. contaminated water)
- Provide a graphic organizer to list observed properties of water
- Include a word bank of terms like "clear," "smelly," "particles," etc.
- Scaffold data collection with partially filled charts
- Allow peer collaboration for observations and questioning
- Use sentence frames for making inferences (e.g., “I think the water has ___ because…”)
- Provide models or diagrams of simple filters
- Offer a choice board of materials to support decision-making
- Use cooperative groups with assigned roles (designer, recorder, tester)
- Introduce a rubric or criteria checklist for "optimized" filters
- Offer guided practice in modifying one variable at a time
- Allow students to reflect with journals or drawings
- Use analogies or simulations to model invisible matter (e.g., dye in water)
- Provide magnified images of microbes or test strips
- Scaffold with a cause-effect map
- Pre-teach key vocabulary like “bacteria,” “contaminant,” and “test”
- Use structured inquiry with step-by-step testing guides
- Include sample analysis cards with prompts
- Provide scaffolded case studies to analyze symptoms and water data
- Use a graphic organizer for cause-and-effect reasoning
- Offer checklists for evaluation of evidence
- Use a visual model or video of boiling and its effects
- Clarify temperature and time concepts with visuals and hands-on measurements
- Use fill-in-the-blank sentence starters for explanations
- Create a comparison chart of different filtration and purification methods
- Scaffold a design thinking process
- Provide picture cards of alternatives (UV light, charcoal, etc.)
- Use a career connection video or reading at multiple reading levels
- Provide annotated diagrams of water treatment plants
- Assign partner summaries using tiered text or captions
- Use interactive models (e.g., pH strips, chlorine tablets demos)
- Provide sentence starters for explanation (e.g., “When we add __, it helps by…”)
- Scaffold predictions with a Before/After chart

- Use anchor charts summarizing earlier lessons
- Provide graphic organizers to compare needs of different organisms
- Include check-ins for students to reflect on key ideas
- Allow choice of case studies that reflect different community issues
- Scaffold with a problem/solution template
- Use jigsaw groups to share and analyze issues collaboratively
- Use a design rubric and revision log to document changes
- Provide teacher modeling of how to refine based on feedback
- Offer guided group feedback sessions
- Use multimodal representations (e.g., model tanks, drawings, simulations)
- Scaffold with a habitat requirement chart
- Provide rubrics or planning templates for final projects

Unit 3:

Accommodations

- Provide a visual sequence organizer to help track time and shadow changes
- Use pause and discuss technique during video to highlight changes
- Allow manipulative models (e.g., mini figures and flashlights) for hands-on reenactment
- Offer subtitles and visuals showing digital vs. sundial time
- Scaffold with a “compare and contrast” chart
- Give real or paper sundials for tactile learners
- Allow students to manipulate models to explore the phenomenon firsthand
- Use guided prompts (e.g., “What part is in light?”)
- Provide graphic diagrams labeling night and day zones
- Use a calendar-style chart with cut-and-paste or drawing activity
- Include Moon phase cards or interactive apps
- Offer sentence frames (e.g., “On Day __, the Moon looked like ___.”)
- Provide controls for speed and labels for planets
- Pair with a structured viewing guide
- Include 3D manipulatives or kinesthetic orbit demonstrations
- Use step-by-step explanations of how the photo was created
- Provide a template to sketch or trace trail patterns
- Support understanding with background on Earth's rotation
- Add color-coding or symbols to differentiate objects
- Provide bilingual labels or a glossary
- Scaffold comparisons with a Venn diagram

- Allow students to physically create the model with teacher guidance
- Use visual scales and proportional model
- Scaffold math integration with measurement conversion tools
- Provide real-time demo or sensory bin
- Use before/after visuals
- Include a cause-effect sentence starter ("When __ happens, __ forms.")
- Provide a transcript with visual annotations
- Offer a weather tool matching sheet
- Use graphic organizers to identify types of instruments and variables
- Show a split-screen with actual and thermal view
- Scaffold with a "hot vs. cool" sorting activity
- Provide touchable samples (e.g., metal, soil, plastic) before video
- Offer a printed version of the animation with labels
- Use interactive fill-in diagrams or color-by-stage activities
- Add movement-based role-play for kinesthetic learners
- Provide narration or captions for cloud types and patterns
- Use slow-motion replay and guided questions
- Include weather journal prompts for observation tracking
- Use dual-language maps if applicable
- Offer color-coded legends and icons
- Scaffold analysis with a chart comparing temperature, humidity, and cloud cover
- Use hands-on demonstrations with guided prediction/reflection
- Offer diagrams showing invisible changes (e.g., air pushing, compressing)
- Use interactive notebooks to draw or label the process step-by-step

Modifications

- Provide a shadow-tracking journal with guided drawing prompts
- Use color overlays to compare shadow positions at different times
- Offer manipulative sun/figure models for recreating time-lapse physically
- Break video into short clips with comprehension questions after each
- Pair with a tactile sundial model and allow hands-on use
- Provide visual clock-sundial comparison charts
- Use teacher-led demonstration with narration and repeated viewings
- Add labels directly on the globe (day/night, east/west)
- Include step-by-step diagrams with arrows to support sequencing
- Provide cut-and-paste sorting tasks for moon phases

- Use calendar visuals with icons of each phase
- Add audio description for students with visual needs
- Offer teacher-guided navigation with pauses and discussion
- Use simplified simulations or analog models for some learners
- Provide orbit tracking worksheets with dotted paths
- Use annotated versions of the image (highlighting arcs/direction)
- Include movement re-creation activities with glow sticks or drawings
- Use “What do you notice?” prompts for visual analysis
- Color-code celestial objects by visibility (day/night/both)
- Offer interactive sorting activity using object cards
- Scaffold with a matching task: object → time of visibility
- Allow students to build scaled models with guidance
- Provide visual scales and proportional diagrams
- Use visual exaggeration first, then adjust to accurate scale
- Condensation Forming on a Cold Glass
- Provide visual before/after comparison cards
- Pair with live or hands-on demo and structured recording sheet
- Include a cause-and-effect graphic organizer
- Use slowed-down version with simplified narration
- Pair video with real-life props (thermometer, rain gauge, etc.)
- Provide a checklist of observed instruments and vocabulary
- Use color key with simplified visuals for thermal images
- Provide guided notes to accompany the video
- Offer hands-on parallel investigation with materials and thermometers
- Add captions or audio labels for each stage
- Provide a cut-and-sequence activity of the cycle
- Include a color-coded diagram for labeling practice
- Pause at intervals to highlight weather changes and vocabulary
- Offer visual timeline or cloud tracker for students to fill in
- Use simplified graphic representation of storm movement
- Provide climate/weather key with icons
- Use a guided comparison template (temperature, precipitation, etc.)
- Offer individual climate zone maps with color coding
- Scaffold demonstration with step-by-step observation sheet
- Use simple illustrations showing molecules or air flow
- Include multiple trials with different conditions (temperature, elevation)

Unit 4:

Accommodations

- Use captioned videos with slowed playback for detailed observation
- Provide a graphic organizer for students to log sunrise/sunset positions
- Offer daily sun tracker charts to record local observations
- Include verbal summaries or visual timelines after viewing
- Allow students to manipulate the globe and light source hands-on
- Use step-by-step instructions with visuals for setup and use
- Provide color-coded diagrams to label hemispheres and light zones
- Include a sequencing activity to describe cause and effect (tilt → seasons)
- Provide physical or digital overlays students can manipulate
- Use highlighted constellations with arrows showing location change
- Pair with vocabulary cards (constellation names, seasons)
- Offer audio guides describing changes across seasons
- Use models (e.g., balls, flashlights) to demonstrate size vs. distance
- Provide a video simulation of an eclipse with narration
- Offer diagrams with scale comparisons and scaffolded vocabulary
- Include reflection prompts with sentence starters ("It looks like the same size because...")
- Provide examples of cultural celebrations with visuals and brief explanations
- Allow students to create their own mini-calendar based on sky patterns
- Use graphic organizers to connect celestial events to dates and traditions
- Provide tiered reading texts or bilingual resources where appropriate
- Use visual schedules or timelines to show changes in sleep/wake cycles
- Provide case studies or simplified stories (e.g., jet lag, SAD) with graphic supports
- Offer sentence starters for explanations ("When it's dark, our bodies...")
- Include interactive models (e.g., light/dark environment scenarios)
- Provide labelled diagrams of related body systems (e.g., endocrine, integumentary)
- Use color-coded flowcharts to show physiological processes (e.g., light → retina → melatonin)
- Include interactive notebooks or cut-and-paste activities for system interactions
- Offer real-life examples or simulations to connect sky patterns with biological effects (e.g., role-play day/night behavior)

Modifications

- Break the video into short clips with visual cues for beginning/midday/end
- Provide a simplified observation log with icons for sun positions
- Use annotated still images from the video for step-by-step analysis

- Offer graphic sentence frames (e.g., “In the morning, the sun is ___.”)
- Pre-label the globe with hemispheres and equator for reference
- Use a worksheet with step-by-step questions aligned to the demonstration
- Replace written responses with drawings or matching activities
- Pair verbal instruction with a visual demonstration script
- Provide color-coded overlays with visible stars labeled
- Simplify to 2–3 key constellations per season to reduce cognitive load
- Offer a matching activity (star pattern → season → name)
- Use interactive digital simulations with narration options
- Use hands-on scale models to show size vs. distance relationship
- Provide step-by-step visual sequence of eclipse formation
- Scaffold learning with cause-effect organizers (e.g., “The Moon blocks the Sun because…”)
- Use video pause-and-predict method to reinforce reasoning
- Offer visual timelines of celestial events with symbols for solstice/equinox
- Provide simple descriptions of cultural events using visuals and key vocabulary
- Allow students to create mini calendars using templates with clip art
- Scaffold writing with sentence starters or oral responses
- Include graphic comic-style stories showing human/animal behavior changes
- Use a chart to track alertness vs. sunlight exposure
- Provide word banks or labeled diagrams for sleep-wake cycle parts
- Allow for role-playing or sorting games to show day/night effects on the body
- Use annotated diagrams of body systems showing sun/light influences
- Provide guided fill-in-the-blank models for hormone or system pathways
- Replace writing-heavy tasks with cut-and-paste sequence cards
- Connect learning with real-world scenarios (e.g., how students feel more tired in winter)

Appendix B

Grade 5 Unit 1: Activities

Student Learning Outcomes

Students will be able to...

- I can create a model of a nurse log ecosystem that includes producers, consumers, and decomposers.
- I can use arrows to show how energy flows from the sun to plants and through the food web.
- I can identify and label where matter (e.g., air, water, nutrients) enters and cycles through the ecosystem.
- I can observe and record how decomposers break down organic material over time.
- I can explain how moisture and sunlight affect the rate of decomposition.
- I can identify evidence of fungi, mold, and insects as decomposers in an ecosystem.
- I can create a comic strip or storyboard that explains how matter cycles and energy flows in a nurse log ecosystem.
- I can write from the perspective of a nurse log to describe the ecological roles it supports over time.
- I can use visuals, labels, and narratives to communicate ecological concepts clearly.
- I can simulate how introducing a non-native species affects energy flow and matter cycling in an ecosystem.
- I can explain how population dynamics shift when a new species is introduced.
- I can propose and communicate strategies for maintaining or restoring ecological balance.
- I can construct a cause-and-effect diagram to show how changes to one species (e.g., decomposers, bullfrogs) impact the entire ecosystem.
- I can identify direct and indirect effects of species interactions within the nurse log ecosystem.
- I can use models to explain both positive and negative feedback within a biological system.
- I can design a public awareness poster that explains the importance of decomposers and nurse logs.
- I can explain the risks associated with invasive species and why biodiversity matters.
- I can communicate environmental concepts in a way that informs and educates others.

Build a Nurse Log Ecosystem Model

- Goal: Students design a 3D model (physical or digital) showing the nurse log, plants, decomposers, and animals.
- Details:
  - Include arrows for energy flow (Sun → plants → animals → decomposers).
  - Use labels or keys to show where matter (air, water, nutrients) comes from.
  - Could use clay, recycled materials, or digital platforms (e.g., Tinkercad).

  Extension: Have students explain how the model would change if a new species (e.g., bullfrog) was added.

Decomposition Investigation

- Goal: Students conduct an experiment to observe decomposition over time.
- Details:
  - Collect small pieces of wood, leaves, and other natural materials (with safety guidelines).
  - Place them in clear containers (mini-terrariums) and observe weekly changes.

- Record evidence of decomposers (mold, fungi, insects) and matter breakdown.
  Extension: Compare decomposition rates with and without moisture or sunlight.

Energy and Matter Flow Comic or Storyboard

- Goal: Students create a comic strip or storyboard that tells the "life story" of a nurse log ecosystem.
- Details:
  - Include characters (the log, a fern, a slug, fungi, a woodpecker).
  - Show how matter cycles and energy flows between them.
  - Include speech bubbles or captions explaining scientific processes.

Ecosystem Impact Simulation

- Goal: Explore the effects of introducing a non-native species.
- Details:
  - Students design and play out a role-play or simple board game where they simulate an ecosystem before and after the arrival of the bullfrog (or another invasive species).
  - Track population changes, matter and energy disruptions.
    Extension: Develop a "solution card" (e.g., ways to restore balance).

Design a Public Awareness Poster

- Goal: Students create posters to teach the community about the importance of nurse logs and decomposers.
- Details:
  - Focus on explaining how nurse logs support life.
  - Include diagrams of energy flow and matter cycling.
  - Add a section warning about the risks of invasive species.

Time-Lapse Nurse Log Diary

- Goal: Students imagine they are a nurse log and write a "diary" over decades.
- Details:
  - Describe how the log supports mosses, ferns, fungi, insects, and animals over time.
  - Include entries on how decomposers break it down and how matter is released back into the environment.
  - End with reflections on changes caused by human activity or species introduction.

Create a Cause-and-Effect Diagram

- Goal: Students build a visual diagram showing how introducing or removing a species affects the ecosystem.
- Details:
  - Start with the nurse log and its dependents.
  - Add branches showing what happens if decomposers are removed or bullfrogs are introduced.
  - Use arrows and symbols to show positive/negative effects.

Grade 5 Unit 2: Activities

Student Learning Outcomes

- I can create a model that shows matter is made of particles too small to be seen.
- I can describe the behavior of particles in solids, liquids, and gases using words, models, or drawings.
- I can observe and measure physical properties of materials (e.g., texture, hardness, mass, temperature).
- I can use data to identify materials based on their properties.
- I can accurately measure and record the mass of substances before and after heating, cooling, or mixing.
- I can use graphs to show that the total amount of matter stays the same even when it changes form.
- I can explain how my data supports the idea that matter is conserved.
- I can conduct an investigation to see if mixing substances creates a new material.
- I can observe signs of chemical change (e.g., gas, color, temperature, new substance).
- I can use evidence from observations to explain whether a chemical reaction happened.
- I can create and revise models to represent particles in different states of matter.
- I can explain scientific ideas using diagrams, models, and clear vocabulary.
- I can present and defend my thinking with evidence from investigations.
- I can plan and carry out fair tests by changing only one variable at a time.
- I can collect, organize, and interpret data using charts, tables, and graphs.
- I can analyze data to identify patterns and support scientific explanations.
- I can define a design problem with clear goals, criteria, and constraints.
- I can brainstorm, build, and test a prototype to solve a real-world problem.
- I can identify parts of my design that failed and explain why.
- I can use evidence from testing to improve my prototype.
- I can work with a team to share ideas and communicate our solution clearly.

Activity

- **Particle Model of Matter Illustration or 3D Build**
  Students create a visual or physical model showing particles in solids, liquids, and gases.

- **Dissolving and Mixing Lab**
  Mix sugar, salt, or baking soda with water and record if mass changes or if new substances form.

- **Mass Conservation Investigation**
  Measure and graph the mass of substances before and after heating, cooling, or mixing to prove conservation of matter.

- **Property Sorting Challenge**
  Examine objects using tools (magnifiers, balances, rulers) and classify them based on observable and measurable properties.

- **Chemical Change Observation Lab**
  Mix substances like vinegar and baking soda to observe gas formation, temperature change, or color change.

- **Engineering Design Challenge: Insulation**
  Design and test a container that keeps an ice cube from melting, using specific materials and time constraints.

- **Mystery Substance Investigation**
  Use property data (e.g., solubility, magnetism, texture, hardness) to identify unknown substances.

- **Data Graphing Activity**
  Create bar graphs or line plots to represent mass or temperature change data from lab investigations.

- **Feedback-Based Redesign**
  After testing a prototype (e.g., filter, boat, or bridge), identify failure points and revise the design using team input and data.

- **Particle Adventure Comic Strip**
  Draw a comic showing how invisible particles behave when matter changes state (e.g., melting ice cube).

- **Chemical Reaction Energy Lab**
  Observe endothermic and exothermic reactions using safe substances and create energy change diagrams.

- **Build and Test a Water Filter**
  Create a simple filtration system to clean muddy water, evaluating performance based on water clarity and filtration time.

- **Classroom "Engineering Expo"**
  Present design challenge results, including initial plan, testing data, what failed, and improvements made.

Grade 5 Unit 3: Activities

Student Learning Outcomes

- I can create a model to show that matter is made of particles too small to see.
- I can explain how particle models help us understand the properties of solids, liquids, and gases.
- I can describe how Earth's gravity pulls objects down.
- I can support claims about gravitational force with observations and evidence.
- I can explain why the Sun looks brighter than other stars based on distance.
- I can use data and graphs to show how shadows change throughout the day.
- I can describe patterns in the sky and relate them to Earth's rotation and the Sun's position.
- I can develop a model to show the components of the geosphere, biosphere, hydrosphere, and atmosphere.
- I can explain how these Earth systems interact using real-world examples.
- I can create graphs that show how water is distributed on Earth.
- I can use visual models to explain why fresh water is limited and needs to be conserved.
- I can describe ways that communities use science to protect Earth's resources and address climate change.
- I can explain why protecting the environment is important for humans and ecosystems.
- I can define a design problem with clear criteria and constraints.
- I can compare multiple solutions to a problem based on how well each meets the criteria.
- I can design, build, and test a prototype to solve a problem and improve it based on test results.
- I can observe and record scientific data using appropriate tools and units.
- I can identify and describe patterns in nature using data and graphs.
- I can develop and use models to represent systems and processes (e.g., water cycle, energy transfer).
- I can use cause-and-effect reasoning to explain scientific phenomena.
- I can support claims with scientific evidence and communicate my ideas clearly.
- I can work with a team to collect, analyze, and present scientific information.
- I can reflect on how understanding Earth systems helps people prepare for environmental changes.

Activity

- **Solar Energy and Surface Heating Lab**
  Students test how different materials (soil, water, sand) absorb heat from sunlight and graph temperature changes.

- **Shadow Tracking Investigation**
  Measure and record shadow length and direction at different times of the day over multiple days; graph and interpret the data.

- **Sun and Star Brightness Simulation**
  Use flashlights and various distances to model how distance affects perceived brightness of the Sun and other stars.

- **Water Cycle in a Bag Model**
  Create a mini water cycle in a sealed plastic bag and observe evaporation, condensation, and precipitation.

- **Earth's Sphere Interactions Diorama or Model**
  Build a model showing interactions between the geosphere, biosphere, hydrosphere, and atmosphere (e.g., volcano erupting and affecting nearby life).

- **Fresh vs. Salt Water Distribution Graph**
  Use pie charts or bar graphs to represent the proportion of saltwater vs. freshwater and where it's stored (glaciers, groundwater, surface water, etc.).

- **Weather Journal and Data Collection**
  Record daily weather data using classroom tools (thermometer, rain gauge, wind vane). Identify weekly patterns and trends.

- **Gravitational Force Demonstration**
  Drop various objects and discuss how Earth's gravity acts in a downward direction regardless of object type.

- **Matter Modeling Activity**
  Create a diagram or 3D model showing how particles are arranged in solids, liquids, and gases—even if we can't see them.

- **Design a Community Water Conservation Tool**
  Identify a real-world issue (e.g., water waste), brainstorm solutions, and build/test a prototype within constraints.

- **Environmental Poster or PSA**
  Research and present ways communities reduce pollution or respond to climate change through a poster or short video.

- **Engineering Design Challenge**
  Students are given a problem (e.g., too much stormwater runoff) and must brainstorm, test, and improve solutions that meet design criteria.

Grade 5 Unit 4: Activities

Student Learning Outcomes

- Describe how gravity pulls objects toward Earth’s surface.
- Support a claim with evidence that the direction of gravitational force is downward toward the center of Earth.
- Explain why the Sun appears brighter than other stars, using reasoning about distance and size.
- Use models and simulations to compare the relative distance and brightness of celestial objects.
- Construct a scientific argument supported by data to explain apparent differences in star brightness.
- Record and analyze daily changes in shadow length and direction caused by Earth’s rotation.
- Create and interpret graphs that show patterns in daylight hours over time.
- Construct a model to explain how Earth’s rotation results in day and night.
- Use a physical or digital model to demonstrate how Earth’s tilt and orbit cause seasonal changes.
- Describe how constellations appear to change throughout the year due to Earth's revolution.
- Use patterns in celestial movement to predict future events such as longer days or visible constellations.
- Explain the relationship between Earth’s position and life events (e.g., plant growth, migration, cultural celebrations).
- Use accurate scientific vocabulary (e.g., axis, rotation, revolution, orbit, gravity, constellation) in explanations and presentations.
- Collaborate with peers to create and revise models of Earth and space systems.
- Communicate scientific findings through writing, models, graphs, and oral presentations.
- Defend explanations using data and observations collected through investigations and research.

Activity

- **Gravity Drop Test**
  - Drop different objects (paper, rock, feather) and observe how gravity acts on each.
  - Use arrows or motion diagrams to show that gravity pulls objects toward the center of the Earth.

- **Sun vs. Stars Brightness Demo**
  - Use flashlights and small LED lights placed at different distances to model how relative distance affects brightness.
  - Compare the size and brightness of the Sun to other stars using photos and scaled models.

- **Shadow Tracker Activity**
  - Measure and record the length and direction of a shadow (e.g., flagpole, stick) throughout the school day.
  - Create a line graph of shadow length vs. time of day and explain the pattern.

- **Constellation Viewer**
  - Use paper tubes, star maps, or a digital simulation (like Stellarium) to view how constellations appear to shift with the seasons.
  - Track and record which constellations are visible during different months.

- **Day/Night Model**
  - Use a globe and flashlight to model how Earth's rotation causes day and night.
  - Students simulate Earth rotating and observe how light affects different locations.

- **Seasons Simulation with Globe and Lamp**
  - Create a physical model showing Earth’s tilt and orbit around the Sun.
  - Use it to explain seasonal changes in daylight and temperature.

- **Sky Log Journal**
  - Students observe the sky each day for two weeks and record the Sun’s position, weather, and visibility of the Moon or stars (if at night).
  - Reflect on changes over time and make predictions.

- **Brightness Argument Writing**
  - Write a short scientific explanation defending why the Sun appears brighter than other stars, using models and evidence about distance.

- **Constellation Art and Explanation**

- Research a seasonal constellation, illustrate it, and write an explanation of when and why it's visible.

- **Daylight Graphing with Real Data**
  - Use online data (e.g., timeanddate.com) to graph sunrise/sunset times over a month or year.
  - Identify and explain seasonal changes in daylight hours.