Unit 3: Living Systems

Content Area: **Science**
Course(s): **Science**
Time Period: **Week 1**
Length: **10 Weeks**
Status: **Published**

Unit Overview

In this unit, students will think about systems on different scales - nutrient and transport systems within an organism that moves matter and provides energy to the individual organism, and feeding relationships in ecosystems that move matter among plants, animals, decomposers and the environment. Students will understand that plants get materials they need for growth primarily from water and air, and that energy in animals' food was once energy from the Sun. Students will explore how human activities in agriculture, industry and everyday life can have major effects on these systems. Also, students will gain experiences that will contribute to the understanding of crosscutting concepts such as patterns, scale, proportion and quantity, systems and system models and energy and matter.

Standards

5-PS3-1	Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.
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.
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.
5-ESS3-1	Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

Disciplinary Core Ideas (DCI's)

5-PS3-1	Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.
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.
5-ESS2-1	Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.
5-ESS3-1	Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

Crosscutting Concepts (CC's)

	In considering phenomena, it is critical to recognize what is relevant at different measures of size, time, and energy and to recognize how changes in scale, proportion, or quantity affect a system's structure or performance.
CCC.4.1	students understand that a system is a group of related parts that make up a whole and can carry out functions its individual parts cannot. They can also describe a system in terms of its components and their interactions.
CCC.7.1	students measure change in terms of differences over time, and observe that change may occur at different rates. Students learn some systems appear stable, but over long periods of time they will eventually change.
SCI.3-5.4.2	A system can be described in terms of its components and their interactions.
SCI.3-5.5.3	Energy can be transferred in various ways and between objects.
SCI.3-5.6.2	Substructures have shapes and parts that serve functions.
SCI.3-5.7.2	Some systems appear stable, but over long periods of time will eventually change.

Science and Engineering Practices (SEP's)

SEP.1.a	Ask questions about what would happen if a variable is changed.
SEP.1.c	Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships.
SEP.2.c	Develop a model using an analogy, example, or abstract representation to describe a scientific principle or design solution.
SEP.2.d	Develop and/or use models to describe and/or predict phenomena.
SEP.3.a	Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.
SEP.4.b	Analyze and interpret data to make sense of phenomena, using logical reasoning, mathematics, and/or computation.
SEP.4.d	Analyze data to refine a problem statement or the design of a proposed object, tool, or process.
SEP.5.b	Organize simple data sets to reveal patterns that suggest relationships.
SEP.6.a	Construct an explanation of observed relationships (e.g., the distribution of plants in the back yard).
SEP.6.b	Use evidence (e.g., measurements, observations, patterns) to construct or support an explanation or design a solution to a problem.
SEP.7.a	Compare and refine arguments based on an evaluation of the evidence presented.
SEP.8.d	Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem.

Essential Questions

Investigation 1 - Systems:

- How can you identify a system?

- Is planet Earth a system?
- What organisms are both predators and prey in the kelp forest ecosystem?
- What happens when compost worms interact with organic litter?

Investigation 2 - Nutrient Systems:

- What does yeast need to break its dormancy?
- How do plants get the food they need?
- How do animals get the nutrients they need?

Investigation 3 - Transport Systems:

- How are nutrients transported to cells in a plant?
- How do humans transport nutrients to all their cells?
- Why do people breathe?

Investigation 4 - Sensory Systems:

- In dodge ball, how are you able to avoid being hit?
- What features of organisms attract attention?
- What behaviors are instinctive and what behaviors are learned?
- What are the parts of a marine ecosystem?

Application of Knowledge: Students will know that…

- A kelp forest has similarities to a rain forest (vertical layering). Phytoplankton are the major producers in most aquatic systems (both marine and freshwater).
- A nutrient is a substance, such as sugar or starch, that is used by a cell to produce the energy needed to perform the functions of life.
- A response is a reaction of a living thing to a stimulus.
- A stimulus is something that triggers (starts) a response. A stimulus is often information received through the senses.
- A system is a collection of interacting objects, ideas, and/or procedures that together define a physical entity or process.
- All cells have basic needs: water, food, gas exchange and waste disposal. Multicellular organisms have systems for transporting nutrients and wastes.
- Animal adaptations include pattern and color that attract attention to warn predators off or to attract a mate.
- Animals communicate to warn others of danger, scare predators away, or locate others of their kind, including family members.
- Animals obtain nutrients by eating other organisms.
- Chlorophyll is the green pigment that absorbs sunlight in the cells of producer organisms.
- Digestion is the process used by animals to break down complex food items into simple nutrients.
- Earth can be described as the interaction of four earth systems: the rocky part (the geosphere), the atmosphere, the water (the hydrosphere), and the complexity of living organisms (the biosphere).

- Food webs and competition for resources exist in marine systems.
- Food webs are made up of producers (organisms that make their own food), consumers (organisms that eat other organisms to obtain food), and decomposers (organisms that consume and recycle dead organisms and organic waste).
- In humans, the respiratory system transports oxygen to the blood and carbon dioxide from the blood.
- In the human circulatory system, blood transport resources to the cells and waste from the cells.
- In vascular plants, xylem tubes carry water and minerals from the plant's roots to all the cells in a one-way flow; phloem tubes carry sugar from the leaves to all the cells that need it.
- Instinctive behaviors, such as knowing what to eat, how to find shelter and how to migrate, help organisms survive.
- Marine ecosystems have biotic (living) and abiotic (nonliving parts). The ocean plays an important role in the carbon cycle.
- Plants make their own food by photosynthesis. Green plant cells make sugar (food) from carbon dioxide and water in the presence of sunlight and release oxygen.
- Vascular bundles are arranged in predictable patterns of veins in the leaves of vascular plants.
- Yeast is a single-celled fungus. Dormant yeast cells can become active when provided with water, warmth and sugar as a food source. Carbon dioxide is a waste by-product of yeast metabolism.

Application of Skills: Students will be able to...

- Analyze and interpret data.
- Ask questions.
- Construct explanations.
- Develop and use models.
- Engage in argument from evidence.
- Obtain, evaluate and communicate information.
- Plan and carry out investigations.
- Use mathematical and computational thinking.

Assessments

Investigation 1 - Systems:

- Formative Assessments: Science notebook entries (Focus Questions - How can you identify a system? Is planet Earth a system? What organisms are both predators and prey in the kelp forest ecosystem? What happens when compost worms interact with organic litter?; New Vocabulary - interact, subsystem, system), Response Sheet, Performance Assessments - Teacher observes the rich conversation among students and the actions they are taking to investigate phenomena or design solutions to problems
- Benchmark Assessments: Survey (pre and post), Investigation 1 I-Check

Investigation 2 - Nutrient Systems:

- Formative Assessments: Science notebook entries (Focus Questions - What does yeast need to break its dormancy? How do plants get the food they need? How do animals get the nutrients they need?; New Vocabulary - carbon dioxide, cell, dormancy, fungus, metabolism, nutrient, sugar, waste, yeast),

Response Sheet
- Benchmark Assessment: Investigation 2 I-Check

Investigation 3 - Transport Systems:

- Formative Assessments: Science notebook entries (Focus Questions - How are nutrients transported to cells in a plant? How do humans transport nutrients to all their cells? Why do people breathe?; New Vocabulary - classify, leaf vein, palmate, parallel, phloem, pinnate, sap, transpiration, vascular bundle, vascular system, xylem), Response Sheet, Performance Assessments - Teacher observes the rich conversation among students and the actions they are taking to investigate phenomena or design solutions to problems
- Benchmark Assessment: Investigation 3 I-Check

Investigation 4 - Sensory Systems:

- Formative Assessments: Science notebook entries (Focus Questions - In dodgeball, how are you able to avoid being hit? What features of organisms attract attention? What behaviors are instinctive and what behaviors are learned? What are the parts of a marine ecosystem?; New Vocabulary - behavior, brain, central nervous system, instinctive, neuron, receptor, response, response time, stimulus), Response Sheet
- Benchmark Assessment: Posttest (identical pre-survey)

Suggested Activities

Investigation 1 - Systems:

Part 1 - Everyday Systems

- Students are introduced to a system as a collection of interacting parts that work together to make a whole or produce an action.
- Assessment - 1 Session, Active Investigation Time - 1 Session, Reading - 1 Session
- Writing/Reading - Science Notebook Entry: Answer the focus question
- Science Resources Book - "Introduction to Systems"

Part 2 - The Earth System

- Students explore Earth as a system.
- Active Investigation Time - 2 Sessions, Reading - 2 Sessions
- Writing/Reading - Science Notebook Entry: *"Physical Systems" Video Review*
- Science Resources Book - "Is Earth a System?", "The Biosphere"
- Video - *Physical Systems*

Part 3 - Kelp Forest Food Web

- Students work with organism cards to create food webs in a kelp forest.
- Active Investigation Time - 1 Session, Reading - 2 Sessions
- Writing/Reading - Science Notebook Entry: *Kelp Forest Food Web*
- Science Resources Book - "Monterey Bay National Marine Sanctuary", Comparing Aquatic and Terrestrial Ecosystems"

- Video - *Web of Life: Life in the Sea*

Part 4 - Recycling

- Each group of students sets up a redworm habitat system to study detritivores.
- Active Investigation Time - 1 Session, Reading - 1 Session, Assessment - 2 Sessions
- Writing/Reading - Science Notebook Entry: *Making a Redworm Habitat*
- Science Resources Book - "Nature's Recycling System"
- Online Activity - "Simulation: Food Webs"

Investigation 2 - Nutrient Systems:

Part 1 - Yeast Nutrition

- Students design an investigation to determine the necessary conditions for activating dry yeast.
- Active Investigation Time - 2 Sessions, Reading - 1 Session
- Writing/Reading - Science Notebook Entry: Answer the focus questions
- Science Resources Book - "There's Yeast in my Bread!"

Part 2 - Plant Nutrition

- Students think about how to break the dormancy of another organism, the wheat plant.
- Active Investigation Time - 5 Sessions, Reading - 1 Session
- Writing/Reading - Science Notebook Entry: Answer the focus question, *Wheat Seed Investigation*
- Science Resources Book - "Producers"

Part 3 - Animal Nutrition

- Students investigate how animals acquire nutrients for their cells by eating and digesting food.
- Active Investigation Time - 2 Sessions, Reading - 2 Sessions, Assessment - 2 Sessions
- Writing/Reading - Science Notebook Entry: *"Getting Nutrients" Review, "The Human Digestive System" Review, "Experiment on Chemical Digestion in the Stomach"*
- Science Resources Book - "Getting Nutrients", The Human Digestive System"
- Videos - *Food Chains, Digestive and Excretory Systems*

Investigation 3 - Transport Systems:

Part 1 - Plant Vascular Systems

- Students continue their exploration of plants by observing the veins in leaves.
- Active Investigation Time - 4 Sessions, Reading - 3 Sessions
- Writing/Reading - Science Notebook Entry: *"Plant Vascular Systems" Review*
- Science Resources Book - "Leaf Classification", "Plant Vascular Systems", "The Story of Maple Syrup"
- Video - *Plant Structure and Growth*
- Online Activity - "Plant Vascular System"

Part 2 - Circulatory System

- Students see a video showing how blood is delivered to every human cell by a system of vessels connected to a pump.
- Active Investigation Time - 2 - 3 Sessions, Reading - 1 Session

- Writing/Reading - Science Notebook Entry: *"The Human Circulatory System" Review*
- Science Resources Book - "The Human Circulatory System"
- Video - *Circulatory and Respiratory Systems*
- Online Activity - "Mammalian Circulatory System"

Part 3 - Respiratory Systems

- Students study the structures and functions of the interacting parts of the respiratory system, learning about the acquisition and distribution of oxygen and the process of waste removal.
- Active Investigation Time - 1 Session, Reading - 1 Session, Assessment - 2 Sessions
- Writing/Reading - Science Notebook Entry: *"The Human Respiratory System" Review, Measuring Vital Capacity*
- Science Resources Book - "The Human Respiratory System", "Other Circulatory and Respiratory Systems"
- Video - *Circulatory and Respiratory Systems*

Investigation 4 - Sensory Systems:

Part 1 - Stimulus/Response

- Through video and text, students learn about the role of sensory and motor neurons in brain messages.
- Active Investigation Time - 1 - 2 Sessions, Reading - 1 Session
- Writing/Reading - Science Notebook Entry: *"Structures of the Brain" Review, Stimulus/Response*
- Science Resources Book - "Stimulus and Response in Humans"
- Video - *The Brain and the Nervous System*
- Online Activity - "Response Timer"

Part 2 - Attention

- Each student chooses attention-getting colors, patterns and a habitat for an action card.
- Active Investigation Time - 1 Session, Reading - 1 Session
- Writing/Reading - Science Notebook Entry: *"Animal Communication" Review*
- Science Resources Book - "Sensory Systems", "Animal Communication"

Part 3 - Instinct and Learning

- Students learn about instinctive and learned behaviors.
- Active Investigation Time - 1 Session, Reading - 1 Session
- Writing/Reading - Science Notebook Entry: *Video Reviews*
- Science Resources Book - "Monarch Migration"
- Videos - *Animal Behavior and Communication, Bugs, Incredible Journeys: A Butterfly Relay*

Part 4 - Ecosystems

- Students bring their study of decomposers to an end by dismantling the worm-habitat system they started 2 months earlier.
- Active Investigation Time - 1 - 2 Sessions, Reading - 1 Session, Assessment - 2 Sessions
- Writing/Reading - Science Notebook Entry: *"North Atlantic Ocean Ecosystem" Review*
- Science Resources Book - "North Atlantic Ocean Ecosystem"
- Video - *Marine Ecosystems*

Activities to Differentiate Instruction

Differentiation for special education:

- General modifications may include:
  - Modifications & accommodations as listed in the student's IEP
  - Assign a peer to help keep student on task
  - Modified or reduced assignments
  - Reduce length of assignment for different mode of delivery
  - Increase one-to-one time
  - Working contract between you and student at risk
  - Prioritize tasks
  - Think in concrete terms and provide hands-on-tasks
  - Position student near helping peer or have quick access to teacher
  - Anticipate where needs will be
  - Break tests down in smaller increments

Differentiation for ELL's:

- General modifications may include:
  - Strategy groups
  - Teacher conferences
  - Graphic organizers
  - Modification plan
  - Collaboration with ELL Teacher
- Content specific vocabulary important for ELL students to understand include: Aquatic ecosystem, algae, atmosphere, bacteria, biosphere, carnivore, compost, consumer, decomposer, ecosystem, energy, food chain, food web, freshwater ecosystem, geosphere (lithosphere), herbivore, hydrosphere, interact, kelp forest, living, marine ecosystem, microorganism, nonliving, omnivore, phytoplankton, predator, prey, producer, recycle, redworm, terrestrial ecosystem, subsystem, system, zooplankton, alveoli, artery, capillary, circulatory system, classify, diaphragm, heart, heart valve, leaf vein, left ventricle, lung, palmate, parallel, phloem, pinnate, respiratory system, right ventricle, sap, transpiration, vascular bundle, vascular system, vein, vital capacity, xylem, adaptation, behavior, brain, central nervous system, inherited trait, instinct, learned behavior, neuron, receptor, reflex, response, response time, stimulus

Differentiation to extend learning for gifted students may include:

- Home/School Extension Activities
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  - Investigation 1 - Systems:

    Extensions: Math problem of the week, investigate food web simulations, research vermicomposting, invite a worm farmer to class, monitor kitchen scraps that can be added to worm bin

  - Investigation 2 - Nutrient Systems:

Extensions: Find sugars in products, math problem of the week, test sugar content of breakfast cereals, read about the man with a hole in his stomach, research other digestive organs, research dialysis, research digestive system sounds - hiccups, burps, stomach growls and sneezes

- Investigation 3 - Transport Systems:

Extensions: Write about making maple syrup, math problem of the week, study a cross section of wood, investigate flowers, research asthma, find out about the hearts of other animals, diagram an organ system, vegetable water transport experiment

- Investigation 4 - Sensory Systems:

Extensions: Write captions for pictures, jumping rope, practice coordination, math problem of the week, compare graphs, investigate other stimuli, drop-and-catch experiment

Integrated/Cross-Disciplinary Instruction

Investigation 1 - Systems:

- Math Extension - Problem of the Week

Investigation 2 - Nutrient Systems:

- Language Extension - Find sugars in product labels
- Math Extension - Problem of the Week

Investigation 3 - Transport Systems:

- Language Extension - Write a report about how to make maple syrup
- Math Extension - Problem of the Week

Investigation 4 - Sensory Systems:

- Language Extension - Write captions to describe stimulus/response events shown in pictures
- Physical Education Extensions - Jump rope sessions to improve coordination, Practice coordination with items such as tee ball and kick ball
- Math Extensions - Problem of the Week, Compare graphs for hand/feet responses

LA.RL.5.4	Determine the meaning of words and phrases as they are used in a text, including figurative language such as metaphors and similes.
LA.RI.5.1	Quote accurately from a text and make relevant connections when explaining what the text says explicitly and when drawing inferences from the text.
LA.RI.5.2	Determine two or more main ideas of a text and explain how they are supported by key details; summarize the text.
LA.RI.5.4	Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a grade 5 topic or subject area.
LA.RI.5.7	Draw on information from multiple print or digital sources, demonstrating the ability to

	locate an answer to a question quickly or to solve a problem efficiently.
LA.RI.5.8	Explain how an author uses reasons and evidence to support particular points in a text, identifying which reasons and evidence support which point(s).
LA.RI.5.9	Integrate and reflect on (e.g., practical knowledge, historical/cultural context, and background knowledge) information from several texts on the same topic in order to write or speak about the subject knowledgeably.
LA.RF.5.4	Read with sufficient accuracy and fluency to support comprehension.
LA.W.5.8	Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources.
LA.W.5.9	Draw evidence from literary or informational texts to support analysis, reflection, and research.
LA.SL.5.1	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 5 topics and texts, building on others' ideas and expressing their own clearly.
LA.SL.5.2	Summarize a written text read aloud or information presented in diverse media and formats (e.g., visually, quantitatively, and orally).
LA.SL.5.4	Report on a topic or text or present an opinion, sequencing ideas logically and using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.
LA.SL.5.5	Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes.
LA.SL.5.6	Adapt speech to a variety of contexts and tasks, using formal English when appropriate to task and situation.

Resources

Investigation 1 - Systems:

- Science Resources Book: "Introduction to Systems", "Is Earth a System?", "The Biosphere", "Monterey Bay National Marine Sanctuary", "Comparing Aquatic and Terrestrial Ecosystems", "Nature's Recycling System"
- Videos: *Physical Systems, Web of Life: Life in the Sea*

Investigation 2 - Nutrient Systems:

- Science Resources Book: "There's Yeast in My Bread!", "Producers", "Getting Nutrients", "The Human Digestive System"
- Videos: *Food Chains, Digestion and Excretory Systems*

Investigation 3 - Transport Systems:

- Science Resources Book: "Leaf Classification", "Plant Vascular Systems", "The Story of Maple Syrup", "The Human Circulatory System", "The Human Respiratory System", "Other Circulatory and Respiratory Systems"
- Videos: *Plant Structure and Growth, Circulatory and Respiratory Systems*

Investigation 4 - Sensory Systems"

- Science Resources Book: "Stimulus and Response in Humans", "Sensory Systems", "Animal

Communication", "Monarch Migration", "North Atlantic Ocean Ecosystem"

- Videos: *The Brain and Nervous System, Animal Behavior and Communication, Bugs Incredible Journeys: A Butterflies Relay, Marine Ecosystems*

21st Century Skills

CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP5	Consider the environmental, social and economic impacts of decisions.
CRP.K-12.CRP7	Employ valid and reliable research strategies.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP11	Use technology to enhance productivity.
CRP.K-12.CRP12	Work productively in teams while using cultural global competence.