

5. Grade 07: Matter and Energy in Organisms and Ecosystems

Content Area: **Science**
Course(s):
Time Period: **Generic Time Period**
Length: **22**
Status: **Not Published**

Stage 1: Desired Results

Unit Overview/ Rationale

How and why do organisms interact with their environment and what are the effects of these interactions?

Students *analyze and interpret data, develop models, construct arguments*, and demonstrate a deeper understanding of the cycling of matter, the flow of energy, and resources in ecosystems. They are able to study patterns of interactions among organisms within an ecosystem. They consider biotic and abiotic factors in an ecosystem and the effects these factors have on populations. They also understand that the limits of resources influence the growth of organisms and populations, which may result in competition for those limited resources. The crosscutting concepts of *matter and energy, systems and system models, patterns, and cause and effect* provide a framework for understanding the disciplinary core ideas. Students demonstrate grade-appropriate proficiency in analyzing and interpret data, developing models, and constructing arguments. Students are also expected to use these practices to demonstrate understanding of the core ideas.

Students provide a mechanistic account for how cells provide a structure for the plant process of photosynthesis in the movement of matter and energy needed for the cell. Students use conceptual and physical models to explain the transfer of energy and cycling of matter as they construct explanations for the role of photosynthesis in cycling matter in ecosystems. They construct scientific explanations for the cycling of matter in organisms and the interactions of organisms to obtain matter and energy from an ecosystem to survive and grow. They understand that sustaining life requires substantial energy and matter inputs, and that the structure and functions of organisms contribute to the capture, transformation, transport, release, and elimination of matter and energy. The crosscutting concepts of *matter and energy and structure and function* provide a framework for understanding of the cycling of matter and energy flow into and out of organisms. Students are also expected to demonstrate proficiency in *developing and using models*. Students use these science and engineering practices to demonstrate understanding of the disciplinary core ideas.

Standards & Indicators

Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of organisms. [Clarification Statement: Emphasis is on tracing movement of matter and flow of energy.] [Assessment Bound

include the biochemical mechanisms of photosynthesis.] ([MS-LS1-6](#))

Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth as this matter moves through an organism. [Clarification Statement: Emphasis is on describing that molecules are broken and that in this process, energy is released.] [Assessment Boundary: Assessment does not include details of the chemical reactions of cellular respiration.] ([MS-LS1-7](#))

Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms. [Clarification Statement: Emphasis is on cause and effect relationships between resources and growth of individual organisms in ecosystems during periods of abundant and scarce resources.] ([MS-LS2-1](#))

Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. [Clarification Statement: Emphasis is on predicting consistent patterns of interactions in different ecosystems in terms of the relationships among and between organisms and components of ecosystems. Examples of types of interactions could include competitive, predatory, and mutually beneficial.]

Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. [Clarification Statement: Emphasis is on describing the conservation of matter and flow of energy into and out of various ecosystems, and on defining the system.] [Assessment Boundary: Assessment does not include the use of chemical reactions to describe the processes.] ([MS-LS2-2](#))

Big Ideas - Students will understand that...

Organisms and populations of organisms are dependent on their environmental interactions with other living things.
Organisms and populations of organisms are dependent on their environmental interactions with nonliving factors.

In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with others for limited resources.

Access to food, water, oxygen, or other resources constrain organisms' growth and reproduction.

Instruction should result in students being able to use arguments based on empirical evidence and scientific

reasoning to support an explanation of how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants. Students may observe examples of plant structures that could affect the probability of plant reproduction, including bright flowers attracting butterflies that transfer pollen, flower nectar and odors that attract pollen-transferring insects, and hard shells on nuts that squirrels bury. Possible activities could include plant experiments (e.g., students could count the number of butterflies on brightly colored plants vs. the number of butterflies on other types of plants and record the data they collect in a table), using microscopes/magnifiers to view plant structures (e.g., dissecting a lily), going on field trips, both virtual and actual (e.g., butterfly garden/botanical garden).

Students may observe examples of animal behaviors that affect the probability of plant reproduction, which could include observing how animals can transfer pollen or seeds and how animals can create conditions for seed germination and growth (e.g., students may conduct an experiment using rapid cycling Brassica rapa [Fast Plant] and collect data on how many plants produce seeds with and without the aid of a pollinator.

Students could then observe examples of animal behaviors (using videos, Internet resources, books, etc.) that could

affect the probability of successful animal reproduction. These behaviors could include nest building to protect young from cold, herding of animals to protect young from predators, and colorful plumage and vocalizations to attract mates for breeding.

Students may be able to identify and describe possible cause-and-effect relationships in factors that contribute to the reproductive success of plants and animals by using probability data from the rapid-cycling *Brassica rapa* (Fast Plant) experiments and drawing conclusions about one relationship between animals and plants.

At this point, students can present an oral and/or written argument supported by evidence and scientific reasoning that characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants, respectively. Students may use evidence from experiments or other sources to identify the role of pollinators in plant reproduction.

Instruction that results in students being able to construct an evidence-based scientific explanation for how environmental and genetic factors influence the growth of organ

isms could begin with students conducting experiments and collecting data on the environmental conditions that effect the growth of organisms (e.g., the effect of variables such as food, light, space, and water on plant growth). Students could then examine genetic factors (inherited traits) that influence the growth of organisms, including parental traits and selective breeding. It is important to note that at this grade level, Mendelian genetics are not a part of student learning. Mendelian genetics will be covered in future grades.

This unit of study could end with students using an oral and/or written argument, supported by evidence and scientific reasoning from their experiments, to explain how environmental conditions and genetic factors affect the growth of an organism.

Essential Questions - What provocative questions will foster inquiry and transfer of learning

How do changes in the availability of matter and energy effect populations in an ecosystem?

How do relationships among organisms, in an ecosystem, effect populations?

How can you explain the stability of an ecosystem by tracing the flow of matter and energy?

Content - Students will know...

- Organisms and populations of organisms are dependent on their environmental interactions with other living things.
- Organisms and populations of organisms are dependent on their environmental interactions with nonliving factors.
- In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with others for limited resources.
- Predatory interactions may reduce the number of organisms or eliminate whole populations of organisms.
- Mutually beneficial interactions may become so interdependent that each organism requires the other for survival.
- The patterns of interactions of organisms with their environment, both its living and nonliving components, are shared.
- Interactions within ecosystems have patterns that can be used to identify cause-and-effect relationships.
- Patterns of interactions among organisms across multiple ecosystems can be predicted.
- Patterns of interactions can be used to make predictions about the relationships among and between organisms and abiotic components of ecosystems.
- Access to food, water, oxygen, or other resources constrain organisms' growth and reproduction.
- Food webs are models that demonstrate how matter and energy are transferred among producers, consumers, and decomposers as the three groups interact within an ecosystem.
- Transfers of matter into and out of the physical environment occur at every level.
- Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments.
- Decomposers recycle nutrients from dead plant or animal matter back to the water in aquatic environments.
- The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem.
- The transfer of energy can be tracked as energy flows through an ecosystem.

Skills - Students will be able to...

Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.

Use cause-and-effect relationships to predict the effect of resource availability on organisms and populations in natural systems.

Construct a scientific explanation for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms based on valid and reliable evidence obtained from sources (including the students' own experiments).

Construct a scientific explanation for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms based on the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

Construct an explanation about interactions within ecosystems.

Include qualitative or quantitative relationships between variables as part of explanations about interactions within ecosystems.

Make predictions about the impact within and across ecosystems of competitive, predatory, or mutually beneficial relationships as abiotic (e.g., floods, habitat loss) or biotic (e.g., predation) components change.

Stage 2: Assessment Evidence

Assessment

foldable (rubric)

Performance-based Assessment (trifold)-environmental impact, historical impact, current day human impact

Chapter test and quiz

Biome Booklet rubric

Stage 3: Learning Plan

Learning Activities

Academic Vocabulary Activities: journals, e-flash cards, puzzles, e-games

Mini-Labs (student engagement)

Launch Labs (teacher and/or student led)

Inquiry Labs (use of inquiry skills)

Interactive technology: classroom presentations, science videos, transparencies, interactive whiteboard activities, online assessments

Language arts strategies: make tables, answer guiding questions, organizing ideas, illustrating ideas, outlines, infer meaning, compare and contrast, make connections

Accommodations for students with IEPs and learning difficulties:

-visual sentence frames using academic vocabulary for discussion

-graphic organizers and sentence starters for literary analysis writing

-Graphic organizers for comparing and contrasting of characters, plot, and theme in order to create a written narrative.

-Graphic organizers/worksheets for book club roles that explains in detail about what each role entails

-Model how to perform specific roles for book clubs

-Use visuals to show important vocabulary for students to make connections

-Have students share their text to text, text to world, and text to self-connections

-One on one teacher support for comprehension and fluency

- Modeling and scaffolding to highlight specific moments, vocabulary, and figurative language, and using context clues to use inference skills

-Show and discuss exemplar writing pieces before students being their own

-Close reading chapters/chunks

-Re-reading key sections for fluency and comprehension

- Colored overlays and reading windows to reduce visual distractions
- Sentence starters for writing assignments
- Vocabulary word banks and strategies (Say it, Define it, Act it)
- Think aloud and Think-Pair-Share

For ELL students:

- visuals for vocabulary
- Word wall
- Additional word work such as illustrating vocabulary and playing vocabulary games
- Partner reading
- Choral reading
- Think-aloud while modeling writing
- Analyze sample summaries before writing
- Color-coded sticky notes for close reading to identify which sticky notes pertain to vocabulary
- Questions about text, etc.
- When students make an error in speaking, answer or restate what they said using the correct form without drawing attention to the mistake.

For gifted students:

- Have students complete extended research projects on a related issue of their choice as it pertains to a content area
 - Students perform a written/oral debate on topics related to content
- webquest-Industrial Revolution
- literature circle (Steam Punk Literature)
- cause and effect charts

virtual labs and lab experiences:

Brain-Pop short videos

Resources

McGraw Hill Science

connected.mcgraw-hill.com

ebackpack

Internet research for biomes

Biome chart

Internet research for china's climate

Unit Reflections & Teacher Notes
