Section C:
Grade 7 Science
Quarter 1
Units of Study

Grade 7 Science, Quarter 1, Unit 1.1

Processes Within an Ecosystem

Overview

Number of instructional days: 23 (1 day = 50 minutes)

Content to be learned

- Understand biotic and abiotic factors.
- Understand population changes in an ecosystem.
- Understand the transfer of the sun's energy.
- Demonstrate energy flow within a food web and ecosystem.
- Understand that matter cycles through different kinds of environments.
- Understand conservation of matter in an ecosystem.

Processes to be used

- Identify biotic factors in an ecosystem.
- Analyze biotic and abiotic factors in an ecosystem.
- Predict outcomes of changes in an ecosystem.
- Use visual models to track populations.
- Explain energy transfer from the sun to living systems.
- Develop models of food chains in environments.
- Diagram steps of matter cycling through an environment.
- Conduct a controlled investigation to observe conservation of matter.

Essential questions

- How do biotic and abiotic factors affect an ecosystem?
- What is the role of the sun's energy in an ecosystem?
- How does matter flow in a closed environment system?
- What are the roles of organisms in an ecosystem?

Written Curriculum

Grade Span Expectations

LS1 - All living organisms have identifiable structures and characteristics that allow for survival (organisms, populations, & species).

LS1 (5-8) INQ+ SAE- 1

Using data and observations about the biodiversity of an ecosystem make predictions or draw conclusionsabout how the diversity contributes to the stability of the ecosystem.

LS1 (7-8) – 1 Students demonstrate understanding of biodiversity by…

1a giving examples of adaptations or behaviors that are specific to a niche (role) within an ecosystem.

1b explaining how organisms with different structures and behaviors have roles that contribute to each other's survival and the stability of the ecosystem.

LS2 - Matter cycles and energy flows through an ecosystem.

LS2 (5-8) INQ+SAE -5

Using data and observations, predict outcomes when abiotic/biotic factors are changed in an ecosystem.

LS2 (7-8) –5 Students demonstrate an understanding of equilibrium in an ecosystem by …

5a identifying which biotic (e.g., bacteria, fungi, plants, animals) and abiotic (e.g., weather, climate, light, water, temperature, soil composition, catastrophic events) factors affect a given ecosystem.

5b analyzing how biotic and abiotic factors affect a given ecosystem.

5c predicting the outcome of a given change in biotic and abiotic factors in an ecosystem.

5d using a visual model (e.g., graph) to track population changes in an ecosystem.

LS2 (5-8) SAE– 6

Given a scenario trace the flow of energy through an ecosystem, beginning with the sun, through organisms in the food web, and into the environment (includes photosynthesis and respiration).

LS2 (7-8) –6 Students demonstrate an understanding of energy flow in an ecosystem by …

6a explaining the transfer of the sun's energy through living systems and its effect upon them.

6d creating or interpreting a model that traces the flow of energy in a food web.

LS2 (5-8) SAE-7

*Given an ecosystem, trace how matter cycles among and between organisms and the physical environment (includes water, oxygen, food web, decomposition, recycling but **not** carbon cycle or nitrogen cycle).*

LS2 (7-8)-7 Students demonstrate an understanding of recycling in an ecosystem by …

7a diagramming or sequencing a series of steps showing how matter cycles among and between organisms and the physical environment.

7b developing a model for a food web of local aquatic and local terrestrial environments.

7d conducting a controlled investigation that shows that the total amount of matter remains constant, even though its form and location change as matter is transferred among and between organisms and the physical environment (e.g., bottle biology, mass of a closed system over time).

Clarifying the Standards

Prior Learning

In grades K–2, students diagrammed and used information from a food web to determine basic needs of organisms. They distinguished between living and nonliving things and identified the sun as a source of heat. In grades 3–4, students identified sources of energy—such as light and food—that are essential for the survival of organisms. They demonstrated that all animals' food sources begin with the sun as the base energy source. In grades 5–6, students defined an ecosystem and identified the sun as the major source of energy. They sequenced energy flow in an ecosystem and completed a food web for a given ecosystem.

Current Learning

Students identify abiotic and biotic factors. They analyze the effects of those factors on an ecosystem, predict changes in biotic and abiotic factors, and track population changes. Students trace energy flow through an ecosystem and food webs. They show how matter cycles through an ecosystem by developing models of food webs, and they conduct an investigation showing that matter will remain constant in a closed system.

Future Learning

In later grades and courses, students will describe and predict how humans and natural events impact the equilibrium of ecosystems. They will explain how chemical elements and compounds cycle through all trophic levels. They will also evaluate evidence from multiple sources and apply that information to environmental issues.

Additional Research Findings

According to *Benchmarks for Science Literacy*, by the end of fifth grade, students should know that some source of energy is needed for all organisms to stay alive and grow (p. 119). By the end of eighth grade, students should know that almost all food energy comes originally from sunlight. They should also know that matter remains constant, even though its form and location change (p. 120).

According to the *Atlas of Science Literacy*, students think organisms and materials in the environment are very different types of matter. They do not recognize that these substances can transform into each other, and they tend to think that energy transformations involve only one form of energy at a time. Students do not realize that matter from dead organisms is converted into other materials in the environment, although they are generally aware that some kind of cyclical process takes place in an ecosystem (pp. 76, 78).

Notes About Resources and Materials

Books

- *Science Explorer: Environmental Science*. Upper Saddle River, NJ: Prentice Hall.

  Chapter 1, Section 1, Living Things and the Environment, pp. 16–21 (Good information for students)

  Exploring Salt as an Abiotic Factor, p. 18

  Energy Flow in an Ecosystem

  Environmental Science, pp. 44–50

  Recycling of Matter through an Ecosystem

  Chapter 2, Section 2, pp. 51–54 (Student information on cycles of matter)

Websites

- Biotic and Abiotic, background information on factors

  http://library.thinkquest.org/CR0210243/Science%20Station/How%20living%20things%20interact%20with%20their%20environment/relationship%20of%20biotic%20and%20abiotic%20factors.htm

- Analysis of Biotic and Abiotic Factors in Human-Altered Environments: Rice Fields, Cattle Grazed Marsh, and Marsh Cattle Exclusionary Zone—a completed study on factors in an environment

  http://library.thinkquest.org/CR0210243/Science%20Station/How%20living%20things%20interact%20with%20their%20environment/relationship%20of%20biotic%20and%20abiotic%20factors.htm

- Identifying Factors in the Environment (a short activity)

  http://library.thinkquest.org/CR0210243/Science%20Station/How%20living%20things%20interact%20with%20their%20environment/relationship%20of%20biotic%20and%20abiotic%20factors.htm

- Population Change: "Oh Deer"—a group simulation that shows how limiting factors affect population growth

  http://seplessons.ucsf.edu/node/140

- Tracing the energy flow through an ecosystem (an online activity that will have students use images to trace energy flow and create a map.)

  http://www.racerocks.com/racerock/education/curricula/projects/energyflow/odumrr.htm

- Developing a model for aquatic environments—developing a model of a food web (an interactive game and background information that should be applicable to local aquatic food webs.)

  http://www.teachersdomain.org/resource/lsps07.sci.life.eco.oceanfoodweb/

- Conducting a controlled investigation that shows the total amount of matter remains constant. (This should be done early in the unit, and data should be recorded daily.)

  http://www.eduref.org/cgi-bin/printlessons.cgi/Virtual/Lessons/Science/Ecology/ECL0014.html

Grade 7 Science, Quarter 1, Unit 1.2

Energy

Overview

Number of instructional days: 7 (1 day = 50 minutes)

Content to be learned

- Understand that energy is necessary for change to occur.
- Understand that radiation, conduction, and convection are means of energy transfer.
- Understand that the motion of molecules changes as phases change.
- Recognize that energy can be transformed, but not destroyed.

Processes to be used

- Design a diagram to show the motion of molecules.
- Describe the motion of molecules in different temperatures.
- Create a visual model of molecules in motion.
- Explain the difference between conduction, convection, and radiation.

Essential questions

- How does the motion of molecules change at different phases?
- Why is energy necessary for change of matter?
- How does heat transfer differ in conduction, convection, and radiation?
- How do different types of materials affect the movement of energy?

Written Curriculum

Grade Span Expectations

PS 2 - Energy is necessary for change to occur in matter. Energy can be stored, transferred, and transformed, but cannot be destroyed.

PS2 (5-8) INQ+SAE+POC – 7

Use data to draw conclusions about how heat can be transferred (convection, conduction, radiation).

7a designing a diagram, model, or analogy to show or describe the motion of molecules for a material in a warmer and cooler state.

7b explaining the difference among conduction, convection and radiation and creating a diagram to explain how heat energy travels in different directions and through different materials by each of these methods.

Clarifying the Standards

Prior Learning

In grades K–2, students learned that the sun is the earth's source of heat energy and that temperature changes when heat is added or subtracted. In grades 3–4, students showed that heat can be produced in many ways and that heat moves from warm objects to cold objects until both objects are the same temperature.

In grades 5–6, students learned about different forms of energy and how they are stored. They also identified real-world applications where heat energy is transferred.

Current Learning

In grade 7, students learn how to design a diagram, model, or analogy to show or describe the motion of molecules for a material in a warmer and cooler state. Students explain the differences among conduction, convection, and radiation. They create a diagram to explain how heat energy travels in different directions and through different materials by each of these processes.

Future Learning

In grades 9–12, students will describe and/or diagram changes in energy that occur in various systems. Students will explain the law of conservation of energy as it relates to the efficiency of a system.

Additional Research Findings

According to *Benchmarks for Science Literacy*, students tend to think energy is something needed to make things go or run, and they have difficulty distinguishing energy needs. Important ideas about energy include that all physical events involve transferring energy or changing one form of energy into another and that whenever energy is reduced in one place, it is increased somewhere else by exactly the same amount. Some of it is likely to transform into heat, which spreads around and therefore is not available for use (p. 81). Many students mistakenly think that cold spreads like heat (p. 84).

According to the *Atlas of Science Literacy*, the relation of heat energy to the disorderly motion of molecules contributes to the constant motion of molecules and a molecular explanation of changes of state (p. 58).

Middle-school students often believe liquids and gasses are not matter, or that these forms of matter are weightless. It is difficult for students of all ages to appreciate the very small size of particles as well as the intrinsic motion of particles within solids, liquids, and gasses (p. 54).

Middle-school students often attribute properties such has hotness and coldness to particles. Often there is belief that heat is produced due to the particles rubbing against each other (NSTA.org).

Notes About Resources and Materials

Websites

- National Science Teacher Association–Middle Level Resources

  www.nsta.org

Energy

- Light Pollution: This lesson investigates light pollution in the night sky.

  http://www.nsta.org/publications/interactive/laptop/lessons/m4.htm

- Solar Race Cars: Solar-powered cars, assembled by students, transform the school sidewalks into a mini racetrack.

  http://www.nsta.org/publications/interactive/laptop/lessons/m5.htm

- American Association of Physics Teachers

  http://www.aapt.org/

- Activities around convection, conduction, and radiation

  www.PowerSleuth.org/teacher

Science Teacher Resources

- Energy transformation activities and information

  http://www-bioc.rice.edu/pblclass/6th%20grade/Matter%20&%20Energy/energy_transformation.htm

- Heat-transfer examples and activities

  http://www.nnin.org/nnin_k12energytransfer.html