MS. Matter and Energy in Organisms and Ecosystems

MS. Matter and Energy in Organisms and Ecosystems

A Performance Expectations MS.LS1.ME

1. Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms. MS.LS1.6
2. Develop a model to describe how food molecules are rearranged through chemical reactions to release energy during cellular respiration and/or form new molecules that support growth as this matter moves through an organism. MS.LS1.7
3. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. MS.LS2.1
4. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. MS.LS2.3
5. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. MS.LS2.4

B Science and Engineering Practices MS.ME.SEP

1. Developing and Using Models MS.ME.SEP.1
   - a. Develop a model to describe phenomena. (MS-LS2-3) MS.ME.SEP.1A
   - b. Develop a model to describe unobservable mechanisms. (MS-LS1-7) MS.ME.SEP.1B
2. Analyzing and Interpreting Data MS.ME.SEP.2
   - a. Analyze and interpret data to provide evidence for phenomena. (MS-LS2-1) MS.ME.SEP.2A
3. Constructing Explanations and Designing Solutions MS.ME.SEP.3
   - a. Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and 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. (MS-LS1-6) MS.ME.SEP.3A
4. Engaging in Argument from Evidence MS.ME.SEP.4
   - a. Construct an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (MS-LS2-4) MS.ME.SEP.4A
5. Scientific Knowledge is Based on Empirical Evidence MS.ME.SEP.5
   - a. Science knowledge is based upon logical connections between evidence and explanations. (MS-LS1-6) MS.ME.SEP.5A
   - b. Science disciplines share common rules of obtaining and evaluating empirical evidence. (MS-LS2-4) MS.ME.SEP.5B

C Disciplinary Core Ideas MS.ME.DCI

1. LS1.C: Organization for Matter and Energy Flow in Organisms MS.ME.DCI.LS1.C
   a. Plants, algae (including phytoplankton), and many microorganisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases oxygen. These sugars can be used immediately or stored for growth or later use. (MS-LS1-6) MS.ME.DCI.LS1.C.1
   b. Within individual organisms, food moves through a series of chemical reactions in which it is broken down and rearranged to form new molecules, to support growth, or to release energy. (MS-LS1-7) MS.ME.DCI.LS1.C.2
2. LS2.A: Interdependent Relationships in Ecosystems MS.ME.DCI.LS2.A
   a. Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. (MS-LS2-1) MS.ME.DCI.LS2.A.1
   b. In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction. (MSLS2- 1) MS.ME.DCI.LS2.A.2
   c. Growth of organisms and population increases are limited by access to resources. (MS-LS2-1) MS.ME.DCI.LS2.A.3
3. LS2.B: Cycle of Matter and Energy Transfer in Ecosystems MS.ME.DCI.LS2.B
   a. Food webs are models that demonstrate how matter and energy is transferred between 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 or 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. (MS-LS2-3) MS.ME.DCI.LS2.B.1
4. LS2.C: Ecosystem Dynamics, Functioning, and Resilience MS.ME.DCI.LS2.C
   a. Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations. (MS-LS2-4) MS.ME.DCI.LS2.C.1
5. PS3.D: Energy in Chemical Processes and Everyday Life MS.ME.DCI.PS3.D
   a. The chemical reaction by which plants produce complex food molecules (sugars) requires an energy input (i.e., from sunlight) to occur. In this reaction, carbon dioxide and water combine to form carbon-based organic molecules and release oxygen. (secondary to MS-LS1-6) MS.ME.DCI.PS3.D.1
   b. Cellular respiration in plants and animals involves chemical reactions with oxygen that release stored energy. In these processes, complex molecules containing carbon react with oxygen to produce carbon dioxide and other materials. (secondary to MS-LS1-7) MS.ME.DCI.PS3.D.2

D Crosscutting Concepts MS.ME.CC

1. Cause and Effect MS.ME.CC.1
   - a. Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-LS2-1) MS.ME.CC.1A
2. Energy and Matter MS.ME.CC.2
   - a. Matter is conserved because atoms are conserved in physical and chemical processes. (MSLS1-7) MS.ME.CC.2A
   - b. Within a natural system, the transfer of energy drives the motion and/or cycling of matter. (MSLS1-6) MS.ME.CC.2B
   - c. The transfer of energy can be tracked as energy flows through a natural system. (MS-LS2-3) MS.ME.CC.2C
3. Stability and Change MS.ME.CC.3
   - a. Small changes in one part of a system might cause large changes in another part. (MS-LS2-4) MS.ME.CC.3A
4. Scientific Knowledge Assumes an Order and Consistency in Natural Systems MS.ME.CC.4
   - a. Science assumes that objects and events in natural systems occur in consistent patterns that are understandable though measurement and observation. (MS-LS2-3) MS.ME.CC.4A