Unit 7: Organization for Matter and Energy Flow in Organisms

CONTENT AREA: General Physical Science	GRADES: 7	UNIT: 7 of 8
Pacing: Approx. 1 Month (March)		

Science and Engineering Practices

Constructing Explanations and Designing Solutions
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)

Developing and Using Models
Use a model based on evidence to illustrate the relationships between systems or between components of a system. **(HS-LS1-7)**

Disciplinary Core Ideas

LS1.C: Organization for Matter and Energy Flow in Organisms

- 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)
- 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)

PS3.D: Energy in Chemical Processes and Everyday Life

- 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)
- Cellular respiration in plants and animals involve 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)

Crosscutting Concepts

Energy and Matter

- Within a natural system, the transfer of energy drives the motion and/or cycling of matter. (MS-LS1-6)
- Matter is conserved because atoms are conserved in physical and chemical processes. (MS-LS1-7)

Connections to Nature of Science

Scientific Knowledge is Based on Empirical Evidence

Science knowledge is based upon logical connections between evidence and explanations. (MS-LS1-6)

Performance Expectations: MS-LS1-6, MS-LS1-7
Evidence Statement(s): MS-LS1-6, MS-LS1-7
Essential Question: How do some organisms turn electromagnetic radiation into matter and energy?
21st Century Skills: 9.2.8.B.3, 9.2.8.B.4
Career Ready Practices: CRP4, CRP6, CRP7

Technology:HS-ETS1-1 HS-ETS1-3

Technical Terms (Suggested)	Core Instructional Materials	Assessment Statement
Cause and Effect Relationships Stimuli Genes Chromosomes Traits Variations Mutations Proteins Sexual Reproduction Asexual Reproduction Genetic Variation Alleles Punnett Squares Photosynthesis Energy Matter Chemical Reactions Sugar Cellular Respiration Chemical Processes Physical Processes ** All terms should be taught in context rather than in isolation. These terms should be addressed after conceptual understanding.**	MS-LS1-6 - Chromebook, internet access, smartboard, notebook, pen, pencil, whiteboard. MS-LS1-7- Computer, Internet access, smartboard, notebook, pen, pencil, whiteboard.	Students who understand the concepts are able to: • 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.

Modifications

English Language Learners	Special Education	At Risk	Gifted & Talented
Scaffolding Word walls Sentence/paragraph frames Bilingual dictionaries/translation Think alouds Read alouds Highlight key vocabulary Annotation guides Think-pair-share Visual aides Modeling Cognates	Word walls Visual aides Graphic organizers Multimedia Leveled readers Assistive technology Notes/summaries Extended time Answer masking Answer eliminator Highlighter Color contrast	Teacher tutoring Peer tutoring Study guides Graphic organizers Extended time Parent communication Modified assignments Counseling	Curriculum compacting Challenge assignments Enrichment activities Tiered activities Independent research/inquiry Collaborative teamwork Higher level questioning Critical/Analytical thinking tasks Self-directed activities

5E Model	
Performance Expectation: MS-LS1-6 **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.**	
Engage: Anticipatory Set	http://studyjams.scholastic.com/studyjams/jams/science/plants/photosynthesis.htm
Exploration: Student Inquiry	Have students view the following video, read the related essay and respond to the related discussion questions. http://www.pbslearningmedia.org/resource/tdc02.sci.life.stru.photosynth/photosynthesis/ Discussion Questions: Do you think that the factory is a good analogy for the process of photosynthesis in plants? Why did von Helmont think that plants got their nourishment from soil? Why did he eliminate soil as a source of nourishment and focus on water? What did he measure to find out if the willow plant got its nourishment from soil? What do you think von Helmont concluded when he measured the change in weight of the plant and the soil? Illuminating Photosynthesis Have students complete the interactive activity which will investigate the process of photosynthesis. http://www.pbslearningmedia.org/resource/tdc02.sci.life.stru.methusweb/illuminating-photosynthesis/ Students can use the following worksheet to guide their exploration. http://d43fweuh3sg51.cloudfront.net/media/assets/wgbh/tdc02/tdc02_doc_photosyn/tdc02_doc_photosyn.pdf Photosynthesis: Watch It Happen http://www.hometrainingtools.com/a/photosynthesis-project/ How do organisms obtain and use matter and energy? How do matter and energy move through an ecosystem? Why are plants critical for the survival of animals? What do plants make that animals need?
Explanation: Concepts & Practices	In these lessons: Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas): LS1.C: Organization for Matter and Energy Flow in Organisms 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. PS3.D: Energy in Chemical Processes and Everyday Life 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)

Elaboration: Extension Activity	Terrarium: Students will build a terrarium and then observe it throughout the unit. To build a simple soda bottle terrarium using stations in the classroom. http://www.uscsd.k12.pa.us/cms/lib02/PA01000033/Centricity/Domain/342/Pennsylvania_Terrariums_Lesson_Plan.pdf
Evaluation: Assessment	Assessment Task A: Written Scientific Explanation 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. Explanation should include evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms. Information learned in above activities should be used to construct the explanation.

5E Model	
Performance Expectation: MS-PS1-7 **Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.**	
Engage: Anticipatory Set	http://ed.ted.com/lessons/the-simple-but-fascinating-story-of-photosynthesis-and-food-amanda-ooten http://www.pbslearningmedia.org/asset/tdc02_int_energyflow/ Continue the lesson by having students journal in their notebooks all the food that they ate from either dinner or lunch. Students should then categorize the food items into plant or animal. Students should then identify what the animals eat as their food source. Teacher facilitates student discussion leading students to the idea that all food traces back to plants. Students are encouraged to find food items they believe do not trace back to plants in order to enhance discussion. Pose the question: "Why are plants so essential to animals?"
Exploration: Student Inquiry	Introduction: All parts of the body (muscles, brain, heart, and liver) need energy to work. This energy comes from the food we eat. Our bodies digest the food we eat by mixing it with fluids (acids and enzymes) in the stomach. When the stomach digests food, the carbohydrate (sugars and starches) in the food breaks down into another type of sugar, called glucose. The stomach and small intestines absorb the glucose and then release it into the bloodstream. Once in the bloodstream, glucose can be used immediately for energy or stored in our bodies, to be used later. In groups, have students develop a diagram which demonstrates the chemical changes that food undergoes and how these changes result in the release of energy. A sample model may begin with the food item, the eating of the item and then the digestion of the item. At each step students should be identifying how the food item was rearranged, where are the molecules going, what are the molecules/energy being used for by the organism.

	Have students walk around the room and look at each other's diagrams. Have them discuss what they noticed about each other's diagrams. If you have access to a document camera you can use this to share the diagrams. Guide the discussion to focus on different steps that groups may have illustrated. Have the class select the steps to make 1 class model. Exploration Questions: How do organisms obtain and use matter and energy? How do matter and energy move through an ecosystem? Why are plants critical for the survival of animals? What do plants make that animals need?
Explanation: Concepts & Practices	In these lessons: Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas): LS1.C: Organization for Matter and Energy Flow in Organisms 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. PS3.D: Energy in Chemical Processes and Everyday Life Cellular respiration in plants and animals involve 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)
Elaboration: Extension Activity	Digital Presentation: Have students synthesize the information they have gathered from the class diagrams to create a digital presentation which illustrates the chemical reactions of food and how this transfers into energy. Students should incorporate information presented in all group diagrams.
Evaluation: Assessment	Assessment Task A: 3D Model Develop a model to describe unobservable mechanisms. Use attached rubric to assess models created by students. 3D Model Rubric

How do some organisms turn electromagnetic radiation into matter and energy?

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.

#	STUDENT LEARNING OBJECTIVES	CORRESPONDING PEs and DCIs
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**. *[Clarification Statement: Emphasis is on tracing movement of matter and flow of energy.] [Assessment Boundary: Assessment does not include the biochemical mechanisms of photosynthesis.]*	**(MS-LS1-6)**
2	**Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.** *[Clarification Statement: Emphasis is on describing that molecules are broken apart and put back together and that in this process, energy is released.] [Assessment Boundary: Assessment does not include details of the chemical reactions for photosynthesis or respiration.]*	**(MS-LS1-7)**

The Student Learning Objectives above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Evidence Statements: MS-LS1-6

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific knowledge, principles, and theories.

Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own

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PS3.D: Energy in Chemical Processes and Everyday Life 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

Crosscutting Concepts

LS1.6

Energy and Matter

Within a natural system, the transfer of energy drives the motion and/or cycling of matter.

LS1.7

Energy and Matter

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. **Connections to Nature of Science** **Scientific Knowledge is Based on Empirical Evidence** Science knowledge is based upon logical connections between evidence and explanations. Evidence Statements: MS-LS1-7 **Developing and Using Models** Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. Develop a model to describe unobservable mechanisms.	carbon-based organic molecules and release oxygen. (secondary) **LS1.C: Organization for Matter and Energy Flow in Organisms** **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.** **PS3.D: Energy in Chemical Processes and Everyday Life Cellular respiration in plants and animals involve 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)**	Matter is conserved because atoms are conserved in physical and chemical processes.

Connections to other DCIs in this grade-band: ***MS.PS1.B ; MS.ESS2.A***
Articulation of DCIs across grade-bands: 5.PS3.D ; 5.LS1.C ; 5.LS2.A ; 5.LS2.B ; HS.PS1.B ; HS.LS1.C ; HS.LS2.B ; HS.ESS2.D
Common Core State Standards Connections: *ELA/Literacy - RST.6-8.1, RST.6-8.2, WHST.6-8.2, WHST.6-8.9, MS.PS1.B* ***Mathematics - 6.EE.C.9*** ***ELA/Literacy - RST.6-8.1, RST.6-8.2, WHST.6-8.2, WHST.6-8.9, MS.PS1.B***