

Marine Biology: Matter and Energy in Organisms and Ecosystems

Stage 1 Desired Results		
ESTABLISHED GOALS: <u>Competencies:</u> <i>Energy & Matter in Systems</i> Students will demonstrate the ability to analyze evidence from a variety of sources (investigations, models) to predict, connect and/or evaluate the cycling of matter and flow of energy within and between systems in order to understand, describe, or predict possibilities and limitations of systems. <i>Stability & Change in Systems</i> Students will demonstrate the ability to investigate and analyze static and dynamic conditions of natural and human designed systems in order to explain and predict changes over time. <i>Nature of Science</i> Student will demonstrate the ability to work collaboratively and individually to generate testable questions or define problems, plan and conduct investigations using a variety of research methods in a various settings, analyze and interpret data, reason with evidence to construct explanations in light of existing theory and previous research, and effectively communicate the research processes and conclusions. - Students will demonstrate the ability to analyze and summarize text and integrate knowledge to make meaning of discipline-specific materials. - Students will demonstrate the ability to produce coherent and supported writing in order to communicate effectively for a range of discipline-specific tasks, purposes, and audiences. - Students will demonstrate the ability to speak purposefully and effectively by strategically making decisions about content, language use, and discourse style. <u>Content Standards:</u> - HS-LS1-5. Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy. - HS-LS1-6. Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon based molecules. - HS-LS1-7 Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy. - HS-LS2-3. Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.	<i>Transfer</i>	
	Students will be able to independently use their learning to make informed decisions and act responsibly based upon their knowledge of inter-related biological systems.	
	<i>Meaning</i>	
	ENDURING UNDERSTANDINGS Students will understand that... - models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales. - changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system. - energy cannot be created or destroyed—it only moves between one place and another place, between objects and/or fields, or between systems. - energy drives the cycling of matter within and between systems.	ESSENTIAL QUESTIONS - Do the needs of humans supercede the needs of a marine ecosystem? - Where does energy go if it can not be created or destroyed?
	<i>Acquisition</i>	
	Students will know... - that the main way that solar energy is captured and stored on Earth is through the complex chemical process known as photosynthesis. - that the process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen. - that, as matter and energy flow through different organizational levels of living systems, chemical elements are recombined in different ways to form different products. - that photosynthesis and cellular respiration (including anaerobic processes) provide most of the energy for life processes.	Students will be skilled at... - developing and using models to illustrate processes. - constructing and revising explanations based on evidence. - using mathematical representations to support claims.

• HS-LS2-4. Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. • HS-LS2-5. Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere,atmosphere, hydrosphere, and geosphere.	• that plants or algae form the lowest level of the food web. At each link upward in a food web, only a small fraction of the matter consumed at the lower level is transferred upward, to produce growth and release energy in cellular respiration at the higher level. Given this inefficiency, there are generally fewer organisms at higher levels of a food web. Some matter reacts to release energy for life functions, some matter is stored in newly made structures, and much is discarded. The chemical elements that make up the molecules of organisms pass through food webs and into and out of the atmosphere and soil, and they are combined and recombined in different ways. At each link in an ecosystem, matter and energy are conserved. • that photosynthesis and cellular respiration are important components of the carbon cycle, in which carbon is exchanged among the biosphere, atmosphere, oceans, and geosphere through chemical, physical, geological, and biological processes. <u>vocabulary:</u> hydrocarbon, cellular respiration, photosynthesis, food web, food chain, matter, element, primary producer, estuary, kelp, coral, zooxanthella, holdfast, stipe, blade, green algae, red algae, carrageen, bladders, brown algae, sea grass, eel grass, primary producers, salt marsh, ecological role, mangroves, algal bloom, phytoplankton, zooplankton, barrier reef, zooxanthella, brackish water, carbon fixation, estuary, dead zone, stratification, epifauna, infauna, gulf stream, nitrogen fixation	
Content Area Literacy Standards	21st Century Skills	
• RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. • RST.11-12.2 Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. • RST.11-12.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. • RST.11-12.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to <i>grades 11-12 texts and topics</i>.	• <i>reason effectively</i> • <i>make judgments and decisions</i> • <i>solve problems</i> • <i>think creatively</i> • <i>collaborate with others</i> • <i>communicate clearly</i>	

• RST.11-12.5 Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas. • RST.11-12.6 Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved. • RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. • RST.11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. • WHST.11-12.1 Write arguments focused on <i>discipline-specific content</i>. • WHST.11-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes. • WHST.11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. • WHST.11-12.6 Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information. • WHST.11-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. • WHST.11-12.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.	• <i>implement innovations</i>
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Stage 2 - Evidence	
<i>Evaluative Criteria</i>	<i>Assessment Evidence</i>
	PERFORMANCE TASK(S):
	OTHER EVIDENCE:

Stage 3 – Learning Plan <i>Summary of Key Learning Events and Instruction</i>	
Language Arts Integration 1.OA.1 Use	Mathematics Integration HSN-Q.A.1 - Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret

	units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays • HSN-Q.A.2 - Define appropriate quantities for the purpose of descriptive modeling • HSN-Q.A.3 - Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. • MP.2- Reason abstractly and quantitatively. • MP.4- Model with mathematics.
<i>Technology Integration</i>	<i>District Materials</i>
• 1.OA.1 Use	
<i>Science and Engineering Practices</i>	
S&EP 1. Asking questions and defining problems S&EP 2. Developing and using models S&EP 4. Analyzing and interpreting data S&EP 6. Constructing explanations (for science) and designing solutions (for engineering) S&EP 7. Engaging in argument from evidence S&EP 8. Obtaining, evaluating, and communicating information.	