AQUATIC BIOLOGY: Fresh Water & Marine Curricular Documents

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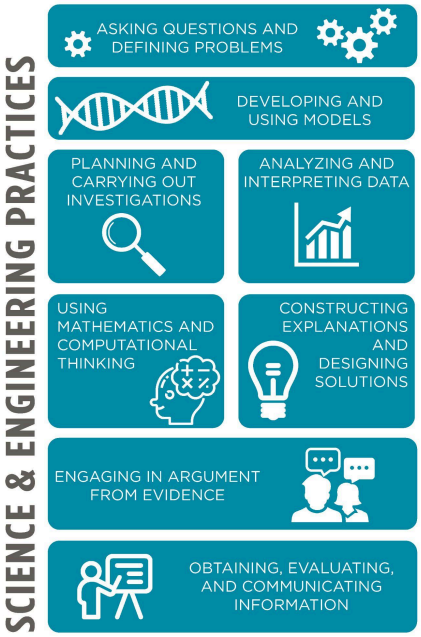
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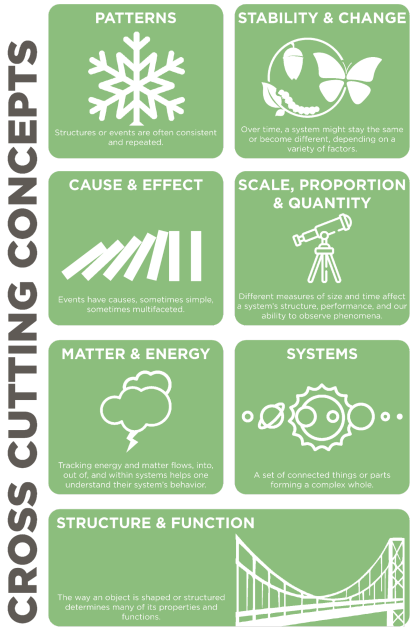
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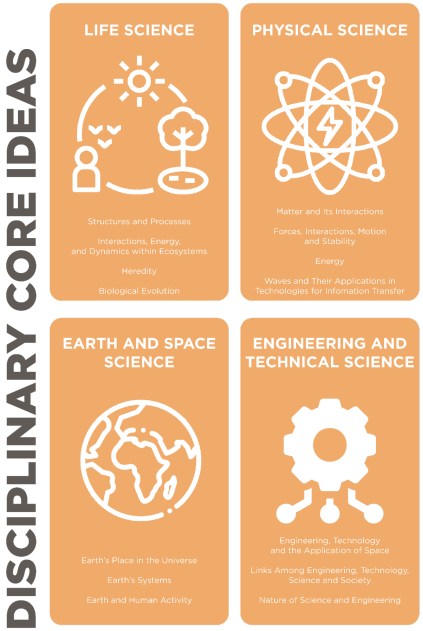
[Aquatic Biology: Fresh Water & Marine] Course Information	
CURRICULUM/CONTENT AREA	**COURSE LENGTH**
Science	1 term
GRADE LEVEL	**DATE LAST REVIEWED**
11-12	2016 Approved Curricular Docs 2023 Evaluation of Program
PREREQUISITE(s) ***if applicable***	**BOARD APPROVAL DATE**
Biology	*December 2024*
PRIMARY RESOURCE ***if applicable***	
Teacher-created Supplemental: CK12	

Desired Results	
COURSE DESCRIPTION	
Aquatic biology is the study of the ecology and behavior of both salt and freshwater plants, animals and protists. The course will also include the geological formation of aquatic regions, climate patterns, and the complexities of global change.	
ENDURING UNDERSTANDINGS	ESSENTIAL QUESTIONS
Patterns: Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them. **Cause and Effect:** Events have causes, sometimes simple, sometimes multifaceted. Deciphering causal relationships, and the mechanisms by	Unit 1 ● How can the scientific method be applied to solve problems in aquatic biology, and how have key contributors, institutions, and technological advancements shaped this field? ● What are the major topographical features and properties of the aquatic ecosystems, and how do they influence aquatic ecosystems and life? Unit 2 ● What are the major taxonomic groupings of aquatic organisms, and what are the key characteristics that define each group? ● How do global threats and human interference impact aquatic ecosystems, and what are the

which they are mediated, is a major activity of science and engineering. **Scale, Proportion, and Quantity:** In considering phenomena, it is critical to recognize what is relevant at different size, time, and energy scales, and to recognize proportional relationships between different quantities as scales change. **Systems and Models:** A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems. **Energy and Matter:** Tracking energy and matter flows, into, and out of, and within systems helps one understand their system's behavior. **Structure and Function:** The way an object is shaped or structured determines many of its properties and functions. **Stability and Change:** For both designed and natural systems, conditions that affect stability and factors that control the rates of change are critical elements to consider and understand.	consequences for ocean health and biodiversity? • How can aquatic biology principles be applied to address global threats, conservation challenges, and the protection of aquatic ecosystems and species?
3 Dimensional Standards	







Cross Cutting Concepts BY GRADE BAND AND UNIT	Unit 1	Unit 2
Standard SCI.CC1 - Patterns Students Observe patterns in systems at different scales and cite patterns as empirical evidence for causality in supporting their explanations of phenomena. They recognize classifications or explanations used at one scale may not be useful or need revision using a different scale, thus requiring improved investigations and experiments. They use mathematical representations to identify and analyze patterns of performance in order to reengineer a designed system.	X	
Standard SCI.CC2 - Cause and Effect Students understand empirical evidence is required to differentiate between cause and correlation and to make claims about specific causes and effects. They suggest cause and effect relationships to explain and predict behaviors in complex natural and designed systems. They also propose causal relationships by examining what is known about smaller scale mechanisms within the system. They recognize changes in systems may have various causes that may not have equal effects.	X	X
Standard SCI.CC3 - Scale, Proportion, and Quantity Students understand the significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs. They recognize patterns observable at one scale may not be observable or exist at other scales, and some systems can only be studied indirectly as they are too small, too large, too fast, or too slow to observe directly. They use orders of magnitude to understand how a model at one scale relates to a model at another scale. They use algebraic thinking to examine scientific data and predict the effect of a change in one variable on another (e.g., linear growth vs. exponential growth).		X
Standard SCI.CC4 - Systems and System Models		

Students investigate or analyze a system by defining its boundaries and initial conditions, as well as its inputs and outputs. They use models (e.g., physical, mathematical, computer models) to simulate the flow of energy, matter, and interactions within and between systems at different scales. They also use models and simulations to predict the behavior of a system and recognize that these predictions have limited precision and reliability due to the assumptions and approximations inherent in the models. They also design systems to do specific tasks.		
Standard SCI.CC5 - Energy and Matter Students understand that the total amount of energy and matter in closed systems is conserved. They describe changes of energy and matter in a system in terms of energy and matter flows into, out of, and within that system. They also learn that 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. In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved.	x	
Standard SCI.CC6 - Structure and Function Students investigate systems by examining the properties of different materials, the structures of different components, and their interconnections to reveal the system's function and solve a problem. They infer the functions and properties of natural and designed objects and systems from their overall structure, the way their components are shaped and used, and the molecular substructures of their various materials.		
Standard SCI.CC7 - Stability and Change Students understand much of science deals with constructing explanations of how things change and how they remain stable. They quantify and model changes in systems over very short or very long periods of time. They see some changes are irreversible, and negative feedback can stabilize a system, while positive feedback can destabilize it. They recognize systems can be designed for greater or lesser stability.	x	

Science and Engineering Practices by GRADE BAND and UNIT	Unit 1	Unit 2
Standard SCI.SEP2 - Developing and Using Models Students use, synthesize, and develop models to predict and show relationships among variables and between systems and their components in the natural and designed world. This includes the following: • Evaluate merits and limitations of two different models of the same proposed tool, process, mechanism, or system in order to select or revise a model that best fits the evidence or design criteria. • Design a test of a model to ascertain its reliability. • Develop, revise, and use models based on evidence to illustrate and predict the relationships between systems or between components of a system. • Develop and use multiple types of models to provide mechanistic accounts and predict phenomena. Move flexibly between these model types based on merits and limitations. Develop a complex model that allows for manipulation and testing of a proposed process or system. • Develop and use a model (including mathematical and computational) to generate data to support explanations, predict phenomena, analyze systems, and solve problems.	x	
Standard SCI.SEP4 - Analyze and Interpret Data Students engage in more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data. This includes the following: • Analyze data using tools, technologies, and models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution. • Apply concepts of statistics and probability to scientific and engineering questions and problems, using digital tools when feasible. • Concepts should include determining the fit of functions, slope, and intercepts to data, along with correlation coefficients when the data is linear. • Consider and address more sophisticated limitations of data analysis (e.g., sample selection) when analyzing and interpreting data.	x	

• Compare and contrast various types of data sets (e.g., self-generated, archival) to examine consistency of measurements and observations. • Evaluate the impact of new data on a working explanation or model of a proposed process or system. • Analyze data to optimize design features or characteristics of system components relative to criteria for success.		
Standard SCI.SEP5 - Mathematics and Computational Thinking Students use algebraic thinking and analysis, a range of linear and nonlinear functions (including trigonometric functions, exponentials, and logarithms), and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions. This includes the following: • Decide if qualitative or quantitative data are best to determine whether a proposed object or tool meets criteria for success. • Create and/or revise a computational model or simulation of a phenomenon, designed device, process, or system. • Use mathematical, computational, and algorithmic representations of phenomena or design solutions to describe and support claims and explanations. • Apply techniques of algebra and functions to represent and solve scientific and engineering problems. • Use simple limit cases to test mathematical expressions, computer programs, algorithms, or simulations of a process or system to see if a model "makes sense" by comparing the outcomes with what is known about the real world. • Apply ratios, rates, percentages, and unit conversions in the context of complicated measurement problems involving quantities with derived or compound units (such as mg/mL, kg/m3, acre-feet, and others).	x	x
Standard SCI.SEP6 - **A.Construct Explanations** Students create explanations that are supported by multiple and independent student generated sources of evidence consistent with scientific ideas, principles, and theories. This includes the following: • Make quantitative and qualitative claims regarding the relationship between dependent and independent variables. • Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources, including students' own investigations, models, theories, simulations, and peer review. • Explanations should reflect 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. • Apply scientific ideas, principles, and evidence to provide an explanation of phenomena taking into account possible, unanticipated effects. • Apply scientific reasoning, theory, and models to link evidence to the claim and to assess the extent to which the reasoning and data support the explanation. B. **Design Solutions** Students create designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. This includes the following: • Design, evaluate, and refine a solution to a complex realworld problem, based on scientific knowledge, student-generated sources of evidence, and prioritized criteria. Consider tradeoffs. • Apply scientific ideas, principles, and evidence to solve design problems, taking into account possible unanticipated effects.	x	x
Standard SCI.SEP7 - Engage in Arguments Students use appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world. Arguments may also come from current scientific or historical episodes in science. This includes the following: • Compare and evaluate competing arguments or design solutions in light of currently accepted explanations, new evidence, limitations (e.g., trade-offs), constraints, and ethical issues. • Evaluate the claims, evidence, and reasoning behind currently accepted explanations or solutions to determine the merits of arguments. • Respectfully provide and receive critiques on scientific arguments by probing reasoning and evidence, by challenging ideas and conclusions, by responding thoughtfully to diverse perspectives, and by determining what additional information is required to resolve contradictions. • Construct, use, and present oral and written arguments or counter-arguments based on data and evidence.	x	x

• Make and defend a claim based on evidence about the natural world or the effectiveness of a design solution that reflects scientific knowledge and student-generated evidence. • Evaluate competing design solutions to a real-world problem based on scientific ideas and principles, empirical evidence, and logical arguments. Consider relevant factors (e.g. economic, societal, environmental, and ethical considerations).		

Disciplinary Core Ideas by GRADE BAND and UNIT		
LIFE SCIENCE		
Standard SCI.LS1		
C. ORGANIZATION FOR MATTER AND ENERGY FLOW IN ORGANISMS: The molecules produced through photosynthesis are used to make amino acids and other molecules that can be assembled into proteins or DNA. Through cellular respiration, matter and energy flow through different organizational levels of an organism as elements are recombined to form different products and transfer energy.	x	
Standard SCI.LS2		
A. **INTERDEPENDENT RELATIONSHIPS IN ECOSYSTEMS:** Ecosystems have carrying capacities resulting from biotic and abiotic factors. The fundamental tension between resource availability and organism populations affects the abundance of species in any given ecosystem. The combination of the factors that affect an organism's success can be measured as a multidimensional niche.		x
B. **CYCLES OF MATTER AND ENERGY TRANSFER IN ECOSYSTEMS:** Photosynthesis and cellular respiration provide most of the energy for life processes. Only a fraction of matter consumed at the lower level of a food web is transferred up, resulting in fewer organisms at higher levels. At each link in an ecosystem, elements are combined in different ways, and matter and energy are conserved. Photosynthesis and cellular respiration are key components of the global carbon cycle.	x	
C. **ECOSYSTEMS DYNAMICS, FUNCTIONING, AND RESILIENCE:** If a biological or physical disturbance to an ecosystem occurs, including one induced by human activity, the ecosystem may return to its more or less original state or become a very different ecosystem, depending on the complex set of interactions within the ecosystem.	x	x
D. **SOCIAL INTERACTIONS AND GROUP BEHAVIOR:** Group behavior has evolved because membership can increase the chances of survival for individuals and their genetic relatives.		x
Standard SCI.LS4		
A. **ADAPTATION:** Evolution results primarily from genetic variation of individuals in a species, competition for resources, and proliferation of organisms better able to survive and reproduce. Adaptation means that the distribution of traits in a population, as well as species expansion, emergence, or extinction, can change when conditions change.		x
B. **BIODIVERSITY AND HUMANS:** Biodiversity is increased by formation of new species and reduced by extinction. Humans depend on biodiversity but also have adverse impacts on it. Sustaining biodiversity is essential to supporting life on Earth.		
PHYSICAL SCIENCE		
Standard SCI.PS1		

A. **NUCLEAR PROCESSES:** Nuclear processes, including fusion, fission, and radioactive decays of unstable nuclei, involve release or absorption of energy.	x	
EARTH AND SPACE SCIENCE		
Standard SCI.ESS1		
A. **EARTH AND THE SOLAR SYSTEM:** Kepler's laws describe common features of the motions of orbiting objects. Observations from astronomy and space probes provide evidence for explanations of solar system formation. Cyclical changes in Earth's tilt and orbit, occurring over tens to hundreds of thousands of years, cause cycles of ice ages and other gradual climate changes.	x	
B. **THE HISTORY OF PLANET EARTH:** The rock record resulting from tectonic and other geoscience processes as well as objects from the solar system can provide evidence of Earth's early history and the relative ages of major geologic formations.	x	
Standard SCI.ESS2		
A. **EARTH MATERIALS AND SYSTEMS:** Feedback effects exist within and among Earth's systems.	x	
B. **PLATE TECTONICS AND LARGE-SCALE SYSTEM INTERACTIONS:** Radioactive decay within Earth's interior contributes to thermal convection in the mantle.	x	
C. **THE ROLES OF WATER IN EARTH'S SURFACE AND PROCESSES:** The planet's dynamics are greatly influenced by water's unique chemical and physical properties.		
D. **WEATHER AND CLIMATE:** The role of radiation from the sun and its interactions with the atmosphere, ocean, and land are the foundation for the global climate system. Global climate models are used to predict future changes, including changes influenced by human behavior and natural factors.	x	
E. **BIOGEOLOGY:** The biosphere and Earth's other systems have many interconnections that cause a continual coevolution of Earth's surface and life on it.		
Standard SCI.ESS3		
A. **NATURAL RESOURCES:** Resource availability has guided the development of human society and use of natural resources has associated costs, risks, and benefits.		
B. **NATURAL HAZARDS:** Natural hazards and other geological events have shaped the course of human history at local, regional, and global scales.		
C. **HUMAN IMPACTS ON EARTH SYSTEMS:** Sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources, including the development of technologies		
D. **GLOBAL CLIMATE CHANGE:** Global climate models used to predict changes continue to be improved, although discoveries about the global climate system are ongoing and continually needed.		
ENGINEERING AND TECHNICAL SCIENCE		
Standard SCI.ETS1		
A. **DEFINING AND DELIMITING ENGINEERING PROBLEMS:** Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. These global challenges also may have manifestations in local communities.		

B.	**DEVELOPING POSSIBLE SOLUTIONS:** When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. Both physical models and computers can be used in various ways to aid in the engineering design process. Computers are useful for a variety of purposes, such as running simulations to test different ways of solving a problem or to see which one is most efficient or economical. They are also useful in making a persuasive presentation to a client about how a given design will meet his or her needs.		

UNIT 1: Aquatic Ecology

This unit explores aquatic biology through the application of the scientific method, examining how contributors, institutions, and technological advancements have shaped the field. It covers the ocean's major topographical features, the effects of human interference and global threats on aquatic ecosystems, and the resulting impacts on ocean health and biodiversity.

UNIT 1 DESIRED RESULTS

ESSENTIAL QUESTION:

- How can the scientific method be applied to solve problems in aquatic biology, and how have key contributors, institutions, and technological advancements shaped this field?
- What are the major topographical features and properties of the ocean, and how do they influence aquatic ecosystems and life?

UNIT PRIORITY STANDARDS: *Students will know and be able to…*

Cross Cutting Concepts	*Science & Engineering Practices (SEP)*	*Disciplinary Core Idea (DCI)*
Energy and Matter ➔ 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 drives the cycling of matter within and between systems. ➔ Energy cannot be created or destroyed; it only moves between one place and another place, between objects and/or fields, or between systems. Stability and Change ➔ Much of science deals with constructing explanations of how things change and how they remain stable. ➔ Change and rates of change can be quantified and modeled	Developing and Using Models ➔ Developing and Using Models Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds. ◆ Develop a model based on evidence to illustrate the relationships between systems or between components of a system. Constructing Explanations and Designing Solutions ➔ Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. ◆ Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, and peer review) and the assumption that theories and laws that describe the natural world	LS1.C: Organization for Matter and Energy Flow in Organisms ➔ LS1.C: Organization for Matter and Energy Flow in Organisms x The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen. LS2.A: Interdependent Relationships in Ecosystems ➔ Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges such as predation, competition, and disease. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem. LS2.B: Cycles of Matter and Energy Transfer in Ecosystems ➔ Photosynthesis and cellular respiration (including anaerobic processes) provide most of the energy for life processes. ➔ 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,

over very short or very long periods of time. Some system changes are irreversible.

Cause and Effect

- ➔ Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.

Scale, Proportion, and Quantity

- ➔ Using the concept of orders of magnitude allows one to understand how a model at one scale relates to a model at another scale.

Patterns

- ➔ Empirical evidence is needed to identify patterns.

operate today as they did in the past and

Using Mathematical and Computational Thinking

- ➔ Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis; a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms; and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.
  - ◆ Use mathematical representations of phenomena or design solutions to support claims.
  - ◆ Use mathematical representations of phenomena or design solutions to support and revise explanations.

Engaging in Argument from Evidence

- ➔ Engaging in argument from evidence in 9– 12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current scientific or historical episodes in science. x
  - Evaluate the claims, evidence, and reasoning behind currently accepted explanations or solutions to determine the merits of arguments.

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.

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

- ➔ A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability

ESS1.B: Earth and the Solar System

- ➔ Cyclical changes in the shape of Earth's orbit around the sun, together with changes in the tilt of the planet's axis of rotation, both occurring over hundreds of thousands of years, have altered the intensity and distribution of sunlight falling on the earth. These phenomena cause a cycle of ice ages and other gradual climate changes. (secondary)

ESS1.C: The History of Planet Earth

- ➔ Continental rocks, which can be older than 4 billion years, are generally much older than the rocks of the ocean floor, which are less than 200 million years old

ESS2.A: Earth Materials and System

- ➔ The geological record shows that changes to global and regional climate can be caused by interactions among changes in the sun's energy output or Earth's orbit, tectonic events, ocean circulation, volcanic activity, glaciers, vegetation, and human activities. These changes can occur on a variety of time scales from sudden (e.g., volcanic ash clouds) to intermediate (ice ages) to very long-term tectonic cycles.
- ➔ Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes.

ESS2.B: Plate Tectonics and Large-Scale System Interactions

- ➔ Plate tectonics is the unifying theory that explains the past and current movements of the rocks at Earth's surface and provides a framework for understanding its geologic history. (ESS2.B Grade 8 GBE) (secondary)

ESS2.D:

- ➔ Weather and Climate The foundation for Earth's global

		climate systems is the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy's reradiation into space. PS1.C: Nuclear Processes ➔ Spontaneous radioactive decays follow a characteristic exponential decay law. Nuclear lifetimes allow radiometric dating to be used to determine the ages of rocks and other materials. (secondary)

3 DIMENSIONAL LEARNING TARGETS

- ➔ HS-LS 2-6 Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.
- ➔ HS-ESS 1-5 Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks.
- ➔ HS-ESS 2-1 Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features.

UNIT 1 ASSESSMENT EVIDENCE

Performance is evaluated in terms of… Students will show their learning by…

Performance Task Description(s):

- ➔ *How do organisms live, grow, and respond to their environment and reproduce?*
  - ◆ HS-LS1-5. Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.
  - ◆ HS-LS 2-3 Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.
  - ◆ HS-LS 2-4 Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem
- ➔ *How (and why} do organisms interact with their environment and what are the effects of these interactions?*
  - ◆ HS-ESS 2-4 Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.
  - ◆ HS-LS 2-6 Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.
  - ◆ HS-ESS 2-2 Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
- ➔ *What Is the universe, and what is Earth's place in it?*
  - ◆ HS-ESS 1-5 Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks.
- ➔ *How and why is Earth constantly changing?*
  - ◆ HS-ESS 2-1 Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features.

Success Criteria Rubrics

- ➔ Standards-aligned rubrics are used for communicating the success criteria, goal setting, reflecting during & after the unit learning, and feedback.

Key Feedback & Assessment Strategies *(What are different ways students can demonstrate their learning?)**:***

- *Conferring/Strategy Groups: Use current evidence of standards & learning targets, feedback is scaffolded based on student strengths, needs, and goals.*
- *Assessment of Unit Skills- Examples for Targeted Data Collection*
  - *Driving Question Board to gather background knowledge and activate prior knowledge*
  - *Student evidence notebooks: focus notes, CER argument writing, model & model revisions*
  - *Checks for understanding (exit slips, quickwrites, etc.) aligned to unit guiding questions*
  - *Lab analysis questions and write-ups*
  - *Assess unit vocabulary terms*
  - *Evaluate student investigation tasks*
  - *Assess key unit concepts (Unit summative assessment)*

➔ *Extensions & College/Career Readiness may include:*

- All lessons: Remove scaffolds provided with Science and Engineering Practices as a way to give students more independent work with the elements of these practices.

The above is not an exhaustive list but shows the possible strategies & tasks that provide meaningful student evidence of learning.

STAGE 3: UNIT LEARNING PLAN (under construction- note: this section does not require board approval) *Planned learning experiences and instruction: Learner Readiness, Key vocab, materials & resources unique to the unit*			
Plan & Prep for the Unit Stage:			
Review Learners' Attributes and needs: • Review 504s & IEP at a Glance • Review current classroom data (by standard) • Review any ACT, screening, or diagnostic data • Other?		Send Family Unit Communication ☐ *ADD example link*	Review any previous student exemplars Proficient ☐ *ADD LINK* Advanced/Excellent ☐ *ADD LINK*
Implementation Stage:			
Key Unit Vocabulary/ Root words:			
Recommended Pacing for Lesson/ Week	**Learning Target (s)**	**Differentiation**	**Teacher Resources:**
LESSON 1, WEEK 1 *Add more rows as needed*		Multiple Means for Students to Access Content: • . • . Multiple Modes for Students to	• *Example- Africa Storyline Calendar w/key videos, data sets & activities*

		Express Understanding •	
LESSON 2, WEEK 2 *Add more rows as needed*		Multiple Means for Students to Access Content: • . • . Multiple Modes for Students to Express Understanding	•

End of Unit Reflection:

- What successes did we have with students learning our desired results (Enduring Understandings, Essential Questions, Priority Standards)? How do we know? (summative results? Progress monitoring data?)
- What opportunities do we have to leverage desired results (Enduring Understandings, Essential Questions, Priority Standards, Anchor Phenomenon) in the future?
- How are we celebrating with students and as a team?

24/25	•
25/26	•
26/27	•
27/28	•

UNIT 2: *Aquatic Life Forms*

This unit focuses on the major taxonomic groupings of aquatic organisms, exploring the defining characteristics of each group. It also examines how aquatic conditions and human activities affect population changes, species declines, and how principles of aquatic biology can be applied to address global threats, conservation efforts, and the protection of aquatic ecosystems.

UNIT 2 DESIRED RESULTS

- What are the major taxonomic groupings of aquatic organisms, and what are the key characteristics that define each group?
- How do global threats and human interference impact aquatic ecosystems, and what are the consequences for ocean health and biodiversity?
- How can aquatic biology principles be applied to address global threats, conservation challenges, and the protection of aquatic ecosystems and species?

UNIT PRIORITY STANDARDS: *Students will know and be able to…*

Cross Cutting Concepts	*Science & Engineering Practices (SEP)*	*Disciplinary Core Idea (DCI)*
➔ Cause and Effect ◆ Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.	➔ Engaging in Argument from Evidence ◆ Engaging in argument from evidence in 9– 12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current scientific or historical episodes in science. ● Evaluate the evidence behind currently accepted explanations to determine the merits of arguments.	➔ **LS2.D: Social Interactions and Group Behavior** ◆ **Group behavior has evolved because membership can increase the chances of survival for individuals and their genetic relatives.**
Cause and Effect ➔ Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.	Engaging in Argument from Evidence ➔ Engaging in argument from evidence in 9-12 builds on K-8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current or historical episodes in	LS4.C: Adaptation ➔ Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline — and sometimes the extinction — of some species.

	science. ● Evaluate the evidence behind currently accepted explanations or solutions to determine the merits of arguments.	➔ Species become extinct because they can no longer survive and reproduce in their altered environment. If members cannot adjust to change that is too fast or drastic, the opportunity for the species' evolution is lost.
Scale, Proportion, and Quantity ➔ Using the concept of orders of magnitude allows one to understand how a model at one scale relates to a model at another scale.	Using Mathematics and Computational ➔ Thinking Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis; a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms; and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions. ● Use mathematical representations of phenomena or design solutions to support and revise explanations.	LS2.A: Interdependent Relationships in Ecosystems ➔ Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges such as predation, competition, and disease. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem. LS2.C: Ecosystem Dynamics, Functioning, and Resilience ➔ A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability.
➔ Cause and Effect ◆ Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. ➔ Scientific Knowledge Assumes an Order and Consistency in Natural Systems ◆ Scientific knowledge is based on the assumption that natural laws operate today as they did in the past and they will continue to do so in the future.	➔ Constructing Explanations and Designing Solutions ◆ Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. ● Construct an explanation	➔ LS4.C: Adaptation ◆ Natural selection leads to adaptation, that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment. That is, the differential survival and reproduction of organisms in a population that have an advantageous heritable trait leads to an increase in the

	based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) 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.	proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not.

3 DIMENSIONAL LEARNING TARGETS

- ➔ HS LS 2-8 Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.
- ➔ HS LS 4-5 Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.
- ➔ HS LS 2-2 Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
- ➔ HS LS 4-4 Construct an explanation based on evidence for how natural selection leads to adaptation of populations.

- ➔ HS-LS1-5. Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.
- ➔ HS-LS 2-3 Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.
- ➔ HS-LS 2-4 Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.
- ➔ HS-ESS 2-4 Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.
- ➔ HS-ESS 2-2 Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.

UNIT 2 ASSESSMENT EVIDENCE

Performance is evaluated in terms of… Students will show their learning by…

- ➔ *How (and why} do organisms interact with their environment and what are the effects of these interactions?*
  - ◆ HS LS 2-8 Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.
  - ◆ HS LS 4-5 Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species

- ➔ *How can there be so many similarities among organisms yet so many different kinds of plants, animals and microorganisms?*
  - ◆ HS LS 2-2 Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
  - ◆ HS LS 4-4 Construct an explanation based on evidence for how natural selection leads to adaptation of populations.

Success Criteria Rubrics

➔ Standards-aligned rubrics are used for communicating the success criteria, goal setting, reflecting during & after the unit learning, and feedback.

Key Feedback & Assessment Strategies *(What are different ways students can demonstrate their learning?)***:**

- *Conferring/Strategy Groups: Use current evidence of standards & learning targets, feedback is scaffolded based on student strengths, needs, and goals.*
- *Assessment of Unit Skills- Examples for Targeted Data Collection*
  - *Driving Question Board to gather background knowledge and activate prior knowledge*
  - *Student evidence notebooks: focus notes, CER argument writing, model & model revisions*
  - *Checks for understanding (exit slips, quickwrites, etc.) aligned to unit guiding questions*
  - *Lab analysis questions and write-ups*
  - *Assess unit vocabulary terms*
  - *Evaluate student investigation tasks*
  - *Assess key unit concepts (Unit summative assessment)*

➔ *Extensions & College/Career Readiness may include:*

- All lessons: Remove scaffolds provided with Science and Engineering Practices as a way to give students more independent work with the elements of these practices.

The above is not an exhaustive list but shows the possible strategies & tasks that provide meaningful student evidence of learning.

STAGE 3: UNIT LEARNING PLAN (under construction- note: this section does not require board approval)

Planned learning experiences and instruction: Learner Readiness, Key vocab, materials & resources unique to the unit

Plan & Prep for the Unit Stage:

Review Learners' Attributes and needs: • Review 504s & IEP at a Glance • Review current classroom data (by standard) • Review any ACT, screening, or diagnostic data • Other?	Send Family Unit Communication ☐ *ADD example link*	Review any previous student exemplars Proficient ☐ *ADD LINK* Advanced/Excellent ☐ *ADD LINK*

Implementation Stage:

Key Unit Vocabulary/ Root words:			
Recommended Pacing for Lesson/ Week	**Learning Target (s)**	**Differentiation**	**Teacher Resources:**
LESSON 1, WEEK 1 *Add more rows as needed*		Multiple Means for Students to Access Content: • . • .	• *Example- Africa Storyline Calendar w/key videos, data sets & activities*

		Multiple Modes for Students to Express Understanding •	
LESSON 2, WEEK 2 *Add more rows as needed*		Multiple Means for Students to Access Content: • . • . Multiple Modes for Students to Express Understanding	•

End of Unit Reflection:

- What successes did we have with students learning our desired results (Enduring Understandings, Essential Questions, Priority Standards)? How do we know? (summative results? Progress monitoring data?)
- What opportunities do we have to leverage desired results (Enduring Understandings, Essential Questions, Priority Standards, Anchor Phenomenon) in the future?
- How are we celebrating with students and as a team?

24/25	•
25/26	•
26/27	•
27/28	•