Life in The Ocean

Missouri Grade-Level Expectations (or other standards)

9-12.LS4.A.1 Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.
9-12.LS2.A.1 Explain how various biotic and abiotic factors affect the carrying capacity and biodiversity of an ecosystem using mathematical and/or computational representations.
9-12.LS2.B.2 Communicate the pattern of the cycling of matter and the flow of energy among trophic levels in an ecosystem
Ocean Literacy Principles The ocean and life in the ocean shape the features of the Earth

Learning Goal	Proficiency Scales
Demonstrate the ability to summarize the basic principles of marine ecology. Characterize, identify, and explain the interconnectedness of marine life, plant and animal	4: Student demonstrates an in-depth inference or advanced application or innovates with the learning goal. 3: Student demonstrates mastery with the learning goal as evidenced by: ● Describe the diversity of habitats available in the oceans. ● Discuss the need for organisms to be able to survive in the oceans, and how they are able to deal with physical parameters, including buoyancy, salinity, temperature, pressure, gas concentrations, nutrient availability, light availability, and circulation patterns. ● Identify organisms at each taxonomic level, both in a food chain and a food web. ● Discuss the importance of primary producers in maintaining the ocean food web. ● Review the process of photosynthesis and discuss primary productivity in terms of carbon dioxide

	● intake and oxygen output. 2: Student demonstrates he/she is nearing proficiency by: ● Recognizing or recalling specific vocabulary, such as Aquaculture, Benthos, Benthic zone, Pelagic zone, Intertidal zone, Sublittoral zone, Bathyal zone, Abyssal zone, Hadal zone, Neritic zone, Oceanic zone, Food web, Coral reef, Plankton ● Performing processes such as: ○ Classification of fauna and flora based on identification ○ Locating the various areas of the ocean and the species that would inhabit 1: Student demonstrates a limited proficiency with the objectives and essential vocabulary with help achieving partial success.

Humans and the Ocean

Missouri Grade-Level Expectations (or other standards)

9-12.ESS3.A.1 Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
9-12.ESS3.A.2 Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on economic, social, and environmental cost-benefit ratios.
9-12.ESS3.C.1 Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.
9-12.ESS3.C.2 Evaluate or refine a technological solution that reduces impacts of human activities on natural systems in order to restore stability and or biodiversity of the ecosystem as well as prevent their reoccurrences.
9-12.ESS3.D.2 Predict how human activity affects the relationships between Earth systems in both positive and negative ways.
Ocean Literacy Principles The ocean and humans are inextricably interconnected.

Learning Goal	Proficiency Scales

Demonstrate the ability to explain how humans use resources from the marine environment and how human impact the marine environment.	4: Student demonstrates an in-depth inference or advanced application or innovates with the learning goal. 3: Student demonstrates mastery with the learning goal as evidenced by: Explaining the ocean affects on the Earth's climate, how it influences our weather, and affects human health. ● Demonstrate understanding of the ocean as a resource for food, medicines, and mineral and energy. ● Explain and know examples of laws, regulations, and resource management affect what is taken out and put into the ocean. ● Analyze how human development and activity have led to pollution, changes to ocean chemistry, and physical modifications. ● Calculate and evaluate how natural hazards have impacted humans due to location near coastal areas. 2: Student demonstrates he/she is nearing proficiency by: ● Recognizing or recalling specific vocabulary, such as point source, nonpoint source, and noise pollution, ocean acidification, erosion, tsunami, hurricane, coral bleaching, climate change ● Performing processes such as: ○ Researching natural and anthropogenic events in the ocean ○ Identifying human impacts on the ocean 1: Student demonstrates a limited proficiency with the objectives and essential vocabulary with help achieving partial success.

History and Formation of the Ocean

Missouri Grade-Level Expectations (or other standards)
9-12.ESS1.C.1 Evaluate evidence of the past and current movements of continental and oceanic crust, the theory of plate tectonics, and relative densities of oceanic and continental rocks to explain why continental rocks are generally much older than rocks of the

ocean floor
9-12.ESS2.A.1 Develop a model to illustrate how Earth's interior and surface processes (constructive and destructive) operate at different spatial and temporal scales to form continental and ocean-floor features.
9-12.ESS2.A.3 Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection.

NOAA Ocean Literacy Standards: Understands the Essential Principles and Fundamental Concepts about the ocean

Learning Goal	Proficiency Scales
The student will demonstrate the ability to describe the geology of the ocean basins and explain the relationships among geologic history, structure of the ocean basins,and the geological characteristics of various marine environments.	4: Student demonstrates an in-depth inference or advanced application or innovates with the learning goal. 3: Student demonstrates mastery with the learning goal as evidenced by: ● Discuss plate tectonics and historical motion of the plates and the impact on the terrestrial and marine environments ● Identify and label the major oceans on a world map. ● Discriminate among the structures of the ocean floor (mid-ocean ridges, seamounts, subduction zones, abyssal plains, and trenches). ● Relate the theories of continental drift and plate tectonics to the evolution of the ocean basins. ● Describe the evolution of today's ocean basins. ● Identify the three major types of plate boundaries and explain the consequences of these interactions. 2: Student demonstrates he/she is nearing proficiency by: ● Recognizing or recalling specific vocabulary, such as Big Bang, oceanography, plate tectonics, ● Performing processes such as: ○ Motion of the movement of the plates (subduction, divergence, etc.)

	1: Student demonstrates a limited proficiency with the objectives and essential vocabulary with help achieving partial success.

Oceanic and Atmospheric Chemistry and Interaction

Missouri Grade-Level Expectations (or other standards)

6-8.ESS2.C.3 Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.
9-12.ESS2.D.1 Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.
Ocean Literacy: Principle 3: The ocean is a major influence on weather and climate.

Learning Goal	Proficiency Scales
● Explain and identify patterns based on the chemical properties of the ocean and demonstrate the ability to explain the physical factors that affect waves, tides, and currents.	4: Student demonstrates an in-depth inference or advanced application or innovates with the learning goal. 3: Student demonstrates mastery with the learning goal as evidenced by: ● Discuss the basic physical properties of a sample of seawater (i.e., temperature, salinity, transparency, density, and pressure). ● Explain the ability of water to act as a solvent of solids and gases. ● Describe the basic chemical composition of seawater. ● Discuss the sources of variations in the ocean's salinity. ● Explain the major biogeochemical cycles that relate to the marine environment(carbon, nitrogen, water). ● Identify the properties and types of ocean waves.

	● Explain how the Coriolis effect and wind patterns create ocean currents. ● Describe how the gravitational pull from the Earth, Moon, and Sun create tides. ● Describe how and why an El Nino event occurs and explain its effects. 2: Student demonstrates he/she is nearing proficiency by: ● Recognizing or recalling specific vocabulary, such as Wind-driven ocean circulation and upwelling. Density driven circulation. The great conveyor belt, circulation, pycnocline, thermocline, halocline. Temperature/salinity/density ... ● Know the types of waves. Shallow vs. deep waves. Tsunamis. Tidal patterns and types ● Describe the physical environment of the United States coastline...coasts, estuaries, beaches, waves, tides... trends in population development along the coast… ● Performing processes such as: ○ Following the currents through the ocean ○ Demonstrate erosion and the impacts 1: Student demonstrates a limited proficiency with the objectives and essential vocabulary with help achieving partial success.