Comparison of National Ocean Literacy Essential Principles & Alaska State Science Standards

Covered in Alaska State Science Standards Partially Covered Not Covered

OCEAN LITERACY: ESSENTIAL PRINCIPLES AND FUNDAMENTAL CONCEPTS	Alaska Standards: Subject and Standard or GLE	Analysis
1 The Earth has one big ocean with many features.		
a. The ocean is the dominant physical feature on our planet Earth—covering approximately 70% of the planet's surface. There is one ocean with many ocean basins, such as the North Pacific, South Pacific, North Atlantic, South Atlantic, Indian and Arctic.	**Essential** ocean concept. Dominant role of ocean as a physical feature on Earth	No
b. An ocean basin's size, shape and features (islands, trenches, mid-ocean ridges, rift valleys) vary due to the movement of Earth's lithospheric plates. Earth's highest peaks, deepest valleys and flattest vast plains are all in the ocean.	**Essential** ocean concept: features of the ocean bottom and relationship to plate tectonics essential	No
c. Throughout the ocean there is one interconnected circulation system powered by wind, tides, the force of the Earth's rotation (Coriolis effect), the Sun, and water density differences. The shape of ocean basins and adjacent land masses influence the path of circulation.	The student demonstrates an understanding of motions, forces, their characteristics, relationships, and effects by [4] SB4.1 simulating that changes in speed or direction of motion are caused by forces (L) [5] SB4.1 investigating that the greater the force acting on an object, the greater the change in motion will be (L) [9] SB4.1 explaining the relationship of motion to an object's mass and the applied force [10] SB4.1 recognizing that when one thing exerts a force on another, an equal amount of force is exerted back on it The student demonstrates an understanding of cycles influenced by energy from the sun and by Earth's position and motion in our solar system by [11] SD3.2 exploring causes and effects related to phenomena (e.g., the aurora, solar winds, Coriolis Effect) (L)	Partial coverage possible. Unlikely to be covered fully.
d. Sea level is the average height of the ocean relative to the land, taking into account the differences caused by tides. Sea level changes as plate tectonics cause the volume of ocean basins and the height of the land to change. It changes as ice caps on land melt or grow. It also changes as sea water expands and contracts when ocean water warms and cools.		No – **connected to climate change**
e. Most of Earth's water (97%) is in the ocean. Seawater has unique properties: it is saline, its freezing point is slightly lower than fresh water, its density is slightly higher, its electrical	The student demonstrates understanding of the structure and properties of matter by [7] SB1.1 using physical properties (i.e., density, boiling point, freezing	Possibly, unlikely to be covered fully. **Essential** ocean

conductivity is much higher, and it is slightly basic. The salt in seawater comes from eroding land, volcanic emissions, reactions at the seafloor, and atmospheric deposition.	point, conductivity) to differentiate among and/or separate materials (i.e., elements, compounds, and mixtures) [8] SB1.1 using physical and chemical properties (i.e., **density**, boiling point, freezing point, conductivity, flammability) to differentiate among materials (i.e., elements, compounds, and mixtures)	concept: **unique** properties of sea water and significance of density to movement of water masses.
f. The ocean is an integral part of the water cycle and is connected to all of the earth's water reservoirs via evaporation and precipitation processes.	The student demonstrates an understanding of the interactions between matter and energy and the effects of these interactions on systems by [3] SB3.1 recognizing that temperature changes cause changes in phases of substances (e.g., ice changing to liquid, water changing to water vapor, and vice versa) [4] SB3.1 explaining that temperature changes cause changes in phases of substances (e.g., ice changing to liquid water and liquid water to water vapor) The student demonstrates an understanding geochemical cycles by [3] SD1.2 describing the water cycle to show that water circulates through the crust, oceans, and atmosphere of Earth [6] SD1.2 identifying the physical properties of water within the stages of the water cycle [10] SD1.2 describing their interrelationships (i.e., water cycle, carbon cycle, oxygen cycle)	Covered. **Connects to human activities and impacts.**
g. The ocean is connected to major lakes, watersheds and waterways because all major watersheds on Earth drain to the ocean. Rivers and streams transport nutrients, salts, sediments and pollutants from watersheds to estuaries and to the ocean.	The student demonstrates an understanding of geochemical cycles by [11] SD1.2 integrating knowledge of the water cycle and biogeochemical cycling to explain changes in the Earth's surface (L)	Possibly partial coverage
h. Although the ocean is large, it is finite and resources are limited.	**Connected to human activities and impacts**	No
2. The ocean and life in the ocean shape the features of the Earth.		
a. Many earth materials and geochemical cycles originate in the ocean. Many of the sedimentary rocks now exposed on land were formed in the ocean. Ocean life laid down the vast volume of siliceous and carbonate rocks.	Science D The student demonstrates an understanding of geochemical cycles by [3] SD1.1 recognizing that most rocks are composed of combinations of different substances [3] SD1.2 describing the water cycle to show that water circulates through the crust, oceans, and atmosphere of Earth [4] SD1.1 describing that most smaller rocks come from the breaking and weathering of larger rocks as part of the rock cycle [4] SD1.2 recognizing the physical properties of water as they relate to the rock cycle [5] SD1.1 observing a model of the rock cycle showing that smaller rocks come from the breaking and weathering of larger rocks and that	Likely partial coverage but emphasis on the ocean's specific role or place in the cycles may not be emphasized.

	smaller rocks (e.g., sediments and sands) may combine with plant materials to form soils (L) [6] SD1.1 exploring the rock cycle and its relationship to igneous, metamorphic, and sedimentary rocks (L) [6] SD1.2 identifying the physical properties of water within the stages of the water cycle [7] SD1.1 describing the rock cycle and its relationship to igneous, metamorphic, and sedimentary rocks [7] SD1.2 explaining the water cycle's connection to changes in the Earth's surface [8] SD1.1 making connections between components of the locally observable geologic environment and the rock cycle (L) [8-9] SD1.2 applying knowledge of the water cycle to explain changes in the Earth's surface [9] SD1.1 using a model to demonstrate the rock cycle (L) [10] SD1.1 using a model to explain the processes (i.e., formation, sedimentation, erosion, reformation) of the rock cycle [10] SD1.2 describing their interrelationships (i.e., water cycle, carbon cycle, oxygen cycle) [11] SD1.1 creating a model to demonstrate the rock cycle (L) [11] SD1.2 integrating knowledge of the water cycle and biogeochemical cycling to explain changes in the Earth's surface (L) The student demonstrates an understanding of the forces that shape Earth by [6] SD2.1 describing the formation and composition (i.e., sand, silt, clay, organics) of soils	
b. Sea level changes over time have expanded and contracted continental shelves, created and destroyed inland seas, and shaped the surface of land.	**Connected to climate change.**	No
c. Erosion—the wearing away of rock, soil and other biotic and abiotic earth materials—occurs in coastal areas as wind, waves, and currents in rivers and the ocean move sediments.	The student demonstrates an understanding of the forces that shape Earth by [4] SD2.1 observing models of how waves, wind, water, and ice shape and reshape the Earth's surface by eroding rock and soil (L) [5] SD2.1 describing how wind and water tear down and build up the Earth's surface resulting in new land formations (i.e., deltas, moraines, and canyons) [6] SD2.1 describing the formation and composition (i.e., sand, silt, clay, organics) of soils [9-11] SD2.1 recognizing the dynamic interaction of erosion and deposition including human causes	Relevant coastal examples; likely covered

d. Sand consists of tiny bits of animals, plants, rocks and minerals. Most beach sand is eroded from land sources and carried to the coast by rivers, but sand is also eroded from coastal sources by surf. Sand is redistributed by waves and coastal currents seasonally.	The student demonstrates an understanding of the forces that shape Earth by [4] SD2.1 observing models of how waves, wind, water, and ice shape and reshape the Earth's surface by eroding rock and soil (L) [5] SD2.1 describing how wind and water tear down and build up the Earth's surface resulting in new land formations (i.e., deltas, moraines, and canyons) [6] SD2.1 describing the formation and composition (i.e., sand, silt, clay, organics) of soils [9-11] SD2.1 recognizing the dynamic interaction of erosion and deposition including human causes The student demonstrates an understanding of geochemical cycles by [7] SD1.2 explaining the water cycle's connection to changes in the Earth's surface [8] SD1.2 applying knowledge of the water cycle to explain changes in the Earth's surface	Covered
e. Tectonic activity, sea level changes, and force of waves influence the physical structure and landforms of the coast.	The student demonstrates an understanding of the forces that shape Earth by [7] SD2.2 describing how the movement of the tectonic plates results in both slow changes (e.g., formation of mountains, ocean floors, and basins) and short-term events (e.g., volcanic eruptions, seismic waves, and earthquakes) on the surface [9-11] SD2.2 describing how the theory of plate tectonics explains the dynamic nature of its surface	Relevant ocean content; likely covered partially
3. The ocean is a major influence on weather and climate. – Combined with Climate Literacy Review		
4. The ocean makes Earth habitable.		
a Most of the oxygen in the atmosphere originally came from the activities of photosynthetic organisms in the ocean.	The student demonstrates an understanding geochemical cycles by [10] SD1.2 describing their interrelationships (i.e., water cycle, carbon cycle, oxygen cycle)	**Essential and unique** ocean content; likely not covered.
b The first life is thought to have started in the ocean. The earliest evidence of life is found in the ocean.		No
5. The ocean supports a great diversity of life and ecosystems.		
a Ocean life ranges in size from the smallest virus to the largest animal that has lived on Earth, the blue whale.		No

b Most life in the ocean exists as microbes. Microbes are the most important primary producers in the ocean. Not only are they the most abundant life form in the ocean, they have extremely fast growth rates and life cycles.		No. **Essential and unique** ocean concept.
c Some major groups are found exclusively in the ocean. The diversity of major groups of organisms is much greater in the ocean than on land.		No. **Essential** ocean concept.
d Ocean biology provides many unique examples of life cycles, adaptations and important relationships among organisms (symbiosis, predator-prey dynamics and energy transfer) that do not occur on land.	The student demonstrates an understanding that all organisms are linked to each other and their physical environments through the transfer and transformation of matter and energy by [3] SC3.2 organizing a simple food chain of familiar plants and animals (L) [4] SC3.1identifying examples of living and non-living things and the relationship between them (e.g., living things need water, herbivores need plants) [4] SC 3.2 identifying a simple food chain of familiar plants and animals, diagramming how energy flows through it; describing the effects of removing one link [5] SC3.1 diagramming how matter and energy are transferred within and between living and nonliving things [5] SC3.2 organizing a simple food chain of familiar plants and animals that traces the source of the energy back to sunlight [7] SC3.2 classifying organisms within a food web as producers, consumers, or decomposers [8] SC3.2 organizing a food web that shows the cycling matter [10] SC3. 2 exploring ecological relationships (e.g., competition, niche, feeding relationships, symbiosis) (L)	Examples from marine ecosystems could be covered but not necessarily.
e The ocean is three-dimensional, offering vast living space and diverse habitats from the surface through the water column to the seafloor. Most of the living space on Earth is in the ocean.		No. **Essential & unique** ocean concept.
f Ocean habitats are defined by environmental factors. Due to interactions of abiotic factors such as salinity, temperature, oxygen, pH, light, nutrients, pressure, substrate and circulation, ocean life is not evenly distributed temporally or spatially, i.e., it is "patchy". Some regions of the ocean support more diverse and abundant life than anywhere on Earth, while much of the ocean is	The student demonstrates an understanding that interactions with the environment provide an opportunity for understanding scientific concepts by [3] SA3.1 observing local conditions that determine which plants and/or animals survive (L) [4] SA3.1 identifying the local limiting factors (e.g., weather, human influence, species interactions) that determine which plants and/or	Examples from marine ecosystems could be covered; but not necessarily.

considered a desert.	animals survive (L) [5] SA3.1 identifying the limiting factors (e.g., weather, human influence, species interactions) that determine which plants and/or animals survive The student demonstrates an understanding that all organisms are linked to each other and their physical environments through the transfer and transformation of matter and energy by [9] SC3.3 identifying dynamic factors (e.g., carrying capacity, limiting factors, biodiversity, and productivity) that affect population size [10] SC3. 2 exploring ecological relationships (e.g., competition, niche, feeding relationships, symbiosis) (L)	
g There are deep ocean ecosystems that are independent of energy from sunlight and photosynthetic organisms. Hydrothermal vents, submarine hot springs, methane cold seeps, and whale falls rely only on chemical energy and chemosynthetic organisms to support life.		No. **Essential and unique** ocean habitat concept.
h Tides, waves and predation cause vertical zonation patterns along the shore, influencing the distribution and diversity of organisms.		No. **Essential and unique** ocean habitat concept.
i Estuaries provide important and productive nursery areas for many marine and aquatic species.		No. **Essential and unique** ocean habitat concept.
6. The ocean and humans are inextricably interconnected. ***Connects to human activities and impacts.***		
a The ocean affects every human life. It supplies freshwater (most rain comes from the ocean) and nearly all Earth's oxygen. It moderates the Earth's climate, influences our weather, and affects human health.		No. **Unique and essential** ocean concept. **Connects to climate change**
b From the ocean we get foods, medicines, and mineral and energy resources. In addition, it provides jobs, supports our nation's economy, serves as a highway for transportation of goods and people, and plays a role in national security.		No. **Unique** ocean concept.
c The ocean is a source of inspiration, recreation, rejuvenation and discovery. It is also an important element in the heritage of	SF Students develop an understanding among scientific, cultural, social and personal	No. **Unique** ocean concept.

many cultures.	perspectives.	
d Much of the world's population lives in coastal areas.		No. **Unique** ocean concept.
e Humans affect the ocean in a variety of ways. Laws, regulations and resource management affect what is taken out and put into the ocean. Human development and activity leads to pollution (point source, non-point source, and noise pollution) and physical modifications (changes to beaches, shores and rivers). In addition, humans have removed most of the large vertebrates from the ocean.	**Connected to human activities and impacts.**	No
f Coastal regions are susceptible to natural hazards(tsunamis, hurricanes, cyclones, sea level change, and storm surges).		No
g Everyone is responsible for caring for the ocean. The ocean sustains life on Earth and humans must live in ways that sustain the ocean. Individual and collective actions are needed to effectively manage ocean resources for all.	**Connected to human activities and impacts.**	No
7. The ocean is largely unexplored.		
a The ocean is the last and largest unexplored place on Earth—less than 5% of it has been explored. This is the great frontier for the next generation's explorers and researchers, where they will find great opportunities for inquiry and investigation.		No. **Unique** ocean concept.
b Understanding the ocean is more than a matter of curiosity. Exploration, inquiry and study are required to better understand ocean systems and processes.	SA Students develop an understanding of the processes and applications of scientific inquiry. SG Students develop an understanding of the history and nature of science.	No
c Over the last 40 years, use of ocean resources has increased significantly, therefore the future sustainability of ocean resources depends on our understanding of those resources and their potential and limitations.	**Connected to human activities and impacts**	No – **Unique and essential** ocean concept
d New technologies, sensors and tools are expanding our ability to explore the ocean. Ocean scientists are relying more and more on satellites, drifters, buoys, subsea observatories and unmanned	The student demonstrates an understanding of how to integrate scientific knowledge and technology to address problems by [4] SE2.1 identifying the function of a variety of tools	Ocean examples could be covered; but not necessarily.

submersibles.	(e.g., spear, hammer, hand lens, kayak, computer) [5] SE 2.1 investigating a problem or project over a specified period of time and identifying the tools and processes used in that project (**L**) The student demonstrates an understanding of how scientific discoveries and technological innovations affect our lives and society by [5] SE3.1 describing the various effects of an innovation (e.g., snow machines, airplanes, immunizations) on the safety, health, and environment of the local community (**L**) The student demonstrates an understanding of the bases of the advancement of scientific knowledge by [9] SG2.1 explaining the importance of innovations (i.e., microscope, immunization, computer)	
e Use of mathematical models is now an essential part of ocean sciences. Models help us understand the complexity of the ocean and of its interaction with Earth's climate. They process observations and help describe the interactions among systems.		No
f Ocean exploration is truly interdisciplinary. It requires close collaboration among biologists, chemists, climatologists, computer programmers, engineers, geologists, meteorologists, and physicists, and new ways of thinking.		No