Virginia Expanded High School Science

Earth Science II: Oceanography

The student will demonstrate an understanding of scientific and engineering practices by OC.1

a asking questions and defining problems OC.1.A

1. ask questions that arise from careful observation of phenomena and/or organisms, from examining models and theories, and/or seeking additional information OC.1.A.1
2. determine which questions can be investigated within the scope of the school laboratory or field OC.1.A.2
3. make hypotheses that specify what happens to a dependent variable when an independent variable is manipulated OC.1.A.3
4. generate hypotheses based on research and scientific principles OC.1.A.4
5. define design problems that involve the development of a process or system with interacting components, criteria, and constraints OC.1.A.5

b planning and carrying out investigations OC.1.B

1. plan and conduct observational and experimental investigations; identify variables, constants, and controls where appropriate OC.1.B.1
2. plan and conduct investigations or test design solutions in a safe and ethical manner including considerations of environmental, social, and personal effects OC.1.B.2
3. determine appropriate sample size and techniques OC.1.B.3
4. select and use appropriate tools and technology to collect and record data OC.1.B.4

c interpreting, analyzing, and evaluating data OC.1.C

1. construct and interpret data tables showing independent and dependent variables, repeated trials, and means OC.1.C.1
2. construct, analyze, and interpret graphical displays of data and consider limitations of data analysis OC.1.C.2
3. use data to build and revise models, to support an explanation for phenomena, or test a solution to problems OC.1.C.3
4. apply mathematical concepts and processes OC.1.C.4
5. analyze data using tools, technologies, and/or models to make valid and reliable scientific claims or determine an optimal design solution OC.1.C.5

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6 analyze data to optimize a design OC.1.C.6

d constructing and critiquing conclusions and explanations OC.1.D

1 construct and revise explanations based on valid and reliable evidence obtained from a variety of sources including models, theories, simulations, peer review, and students' own investigations OC.1.D.1

2 make quantitative and/or qualitative claims based on data OC.1.D.2

3 apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and design solutions OC.1.D.3

4 compare and evaluate competing arguments or design solutions in light of currently accepted explanations and new scientific evidence OC.1.D.4

5 make and support a claim using empirical evidence and scientific reasoning OC.1.D.5

6 evaluate a claim by applying scientific reasoning, theory, and/or models to link evidence to assess the extent to which the reasoning and data support the explanation or conclusion OC.1.D.6

e developing and using models OC.1.E

1 evaluate the merits and limitations of models OC.1.E.1

2 develop, revise, and/or use models based on evidence to illustrate or predict relationships, to support explanations, predict phenomena, analyze systems, and/or solve problems OC.1.E.2

3 apply mathematical and statistical concepts and processes in building and revising models, supporting explanations of phenomena, or testing solutions to problems OC.1.E.3

f obtaining, evaluating, and communicating information OC.1.F

1 compare, integrate, and evaluate sources of information presented in different media or formats to address a scientific question or solve a problem OC.1.F.1

2 gather, read, and evaluate scientific and/or technical information from multiple authoritative sources, assessing the evidence and credibility of each source OC.1.F.2

3 communicate scientific and/or technical information about phenomena and/or a design process in multiple formats OC.1.F.3

The student will investigate and understand that ocean ecosystems support a great diversity of life. Demonstration of the ess... pra...

a Explain how biotic and abiotic factors affect biodiversity within marine ecosystems. OC.2.A

b Make, support, and evaluate a claim about factors that promote and control the locations of primary productivity and its effect on ocean ecosystems. OC.2.B

...dentify characteristics of major groups (kingdom, phylum, and class) of marine ...rganisms. OC.2.C

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	d Make, support, and evaluate a claim about how unique morphological features of marine organisms help them survive and thrive in their respective marine niches. OC.2.D
	e Explain the benefit of daily vertical migration for zooplankton and its effects on ocean ecosystems. OC.2.E
	f Develop and use a model to predict the transfer of energy within ocean ecosystems and predict the effects of natural and anthropogenic events on ecosystem health. OC.2.F
	g Compare the relative roles of chemosynthesis and photosynthesis in biological productivity of ocean ecosystems. OC.2.G
	h Debate advantages and disadvantages of a solution to a natural or anthropogenic threat to a marine organism. OC.2.H
The student will investigate and understand that the properties of seawater enable distinct biological and physical characteristics within the ocean and ecosystems. Demonstration of the essential knowledge and practices includes: OC.3	**a** Explain how the properties of seawater (pH, dissolved oxygen, turbidity, density, and salinity) affect biodiversity in ocean ecosystems. OC.3.A
	b Plan and conduct an investigation to determine how salinity affects density of water. OC.3.B
	c Make, support, and evaluate a claim about the relationship between the density and depth of seawater. OC.3.C
	d Explain how the relationships among temperature, density, depth, and salinity can be used to predict effects on ocean currents. OC.3.D
	e Explain how the properties of the thermocline, halocline, and pycnocline create distinct ecosystems. OC.3.E
	f Describe the variation of the transmission of light through zones of the ocean and determine biological adaptations that allow organisms to survive within each zone. OC.3.F
	g Analyze data to understand the relationship among dissolved gases, temperature, and pressure with increasing depth and effects on marine life. OC.3.G
	h Develop and use a model to explain thermohaline circulation and the effect on ecosystems. OC.3.H
	i Plan and conduct an investigation that demonstrates the ocean's capacity to serve as a buffer and predict the effects of changing pH levels on marine ecosystems. OC.3.I
Th inv un	**Explain how water moderates regional climate and local weather onditions.** OC.4.A

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are interactions between the ocean and the atmosphere that influence weather, climate, and ocean systems. Demonstration of the essential knowledge and practices includes: OC.4	b Develop and use a model to explain why the Coriolis Effect occurs and how it influences global wind patterns and oceanic surface currents. OC.4.B
	c Identify major surface currents, their characteristics (temperature, origin, and direction of motion) and explain how they affect local climates. OC.4.C
	d Predict the formation and severity of low-pressure tropical systems over the ocean and describe potential hazards when they reach land. OC.4.D
	e Develop and use a model to explain interrelationships among wind, ocean current, and climate patterns. OC.4.E
	f Explain the atmospheric causes of Ekman transport and its effect on marine and climate systems. OC.4.F
	g Make, support, and evaluate a claim about how climate variability and change influence ocean currents and stratification. OC.4.G
	h Make, support, and evaluate a claim about how atmospheric changes affect ocean systems. OC.4.H
The student will investigate and understand that Earth's geologic, atmospheric, and astronomical processes interact with the ocean to shape its physical features, movement, and coastal environments. Demonstration of the essential knowledge and practices includes: OC.5	a Make, support, and evaluate a claim about the role of plate tectonics in shaping the physical features of the ocean and continents. OC.5.A
	b Explain how dynamic events at plate boundaries (earthquakes, volcanoes, seafloor spreading, and hot spots) influence oceans and continents. OC.5.B
	c Develop and use a model to explain the relative position of the sun, moon, and Earth to predict spring and neap tides. OC.5.C
	d Explain the role of gravitational forces among Earth, moon, and sun and resulting tides. OC.5.D
	e Interpret a tide table to determine tidal range and the type of daily tides (diurnal, semi-diurnal, mixed, and continental interference). OC.5.E
	f Develop and use a model to explain how factors (wind duration, fetch, and wind speed) lead to the formation of ocean waves. OC.5.F
	g Compare different types of waves and how coastal shorelines change the dynamic of the waves. OC.5.G
	h Develop and use a model to explain the formation of barrier islands and how they form a defense against rising sea level and storm waves. OC.5.H
	i Research and describe events of how waves, tides, and/or sea level change affected the physical structure of a local coastline. OC.5.I

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	j Compare the advantages and disadvantages of hard and soft stabilization methods on coastline stabilization. OC.5.J
	k Research and describe the origin, composition, particle size, thickness, and distribution of oceanic sediments, including their classification. OC.5.K
The student will investigate and understand that historic and on-going oceanic explorations contribute to the understanding of ocean systems. Demonstration of the essential knowledge and practices includes: OC.6	**a** Research past and modern explorations to explain how exploration contributes to understanding the ocean. OC.6.A
	b Describe how historical and current tools, mapping technologies (lead-line, echo sounding, multi-beam sonar, seismic profiling, side-scan sonar, and sea surface altimetry), and the contributions of research vessels have expanded human understanding of ocean ecosystems. OC.6.B
	c Research major developments in the understanding of ocean systems and processes. OC.6.C
	d Make, support, and evaluate a claim about the effect of natural and anthropogenic events on ocean ecosystems using modern satellite imagery and data sets. OC.6.D
	e Identify a current global problem and propose a solution based on understanding ocean systems. OC.6.E
The student will investigate and understand that the ocean is of important social and economic value globally and in Virginia. Demonstration of the essential knowledge and practices includes: OC.7	**a** Make, support, and evaluate a claim about how the extraction of physical and biological resources from the ocean affects marine ecosystems. OC.7.A
	b Compare global consumerism to our national and local trends and explain these effects on Virginia, local coastal, and offshore environments. OC.7.B
	c Make, support, and evaluate a claim about the benefits and drawbacks of various uses of the ocean. OC.7.C
	d Research local and global issues, policies, and laws that promote responsible stewardship of the oceans. OC.7.D
	e Debate advantages and disadvantages of the law of the sea. OC.7.E
	f Design, evaluate, and refine a solution for reducing the effects of a natural event or a human activity on Virginia's ocean systems, shorelines, local communities, and on ecosystem biodiversity. OC.7.F
	g Make, support, and evaluate a claim about how continued coastal population growth in Virginia affects sustainability OC.7.G