Texas Science

Aquatic Science (2021)

Adopted 2021

The student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to explain phenomena or design solutions using appropriate tools and models. The student is expected to: A.1

- **A.** ask questions and define problems based on observations or information from text, phenomena, models, or investigations; A.1.A
- **B.** apply scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems; A.1.B
- **C.** use appropriate safety equipment and practices during laboratory, classroom, and field investigations as outlined in Texas Education Agency-approved safety standards; A.1.C
- **D.** use appropriate tools such as Global Positioning System (GPS), Geographic Information System (GIS), weather balloons, buoys, water testing kits, meter sticks, metric rulers, pipettes, graduated cylinders, standard laboratory glassware, balances, timing devices, pH meters or probes, various data collecting probes, thermometers, calculators, computers, internet access, turbidity testing devices, hand magnifiers, work and disposable gloves, compasses, first aid kits, field guides, water quality test kits or probes, 30-meter tape measures, tarps, ripple tanks, trowels, screens, buckets, sediment samples equipment, cameras, flow meters, cast nets, kick nets, seines, computer models, spectrophotometers, stereomicroscopes, compound microscopes, clinometers, and field journals, various prepared slides, hand lenses, hot plates, Petri dishes, sampling nets, waders, leveling grade rods (Jason sticks), protractors, inclination and height distance calculators, samples of biological specimens or structures, core sampling equipment, fish tanks and associated supplies, and hydrometers; A.1.D
- **E.** collect quantitative data using the International System of Units (SI) and qualitative data as evidence; A.1.E
- **F.** organize quantitative and qualitative data using probeware, spreadsheets, lab notebooks or journals, models, diagrams, graphs paper, computers, or cellphone applications; A.1.F
- **G.** develop and use models to represent phenomena, systems, processes, or solutions to engineering problems; and A.1.G
- **H.** distinguish between scientific hypotheses, theories, and laws. A.1.H

The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs. The student is expected to: A.2	**A.** identify advantages and limitations of models such as their size, scale, properties, and materials; A.2.A **B.** analyze data by identifying significant statistical features, patterns, sources of error, and limitations; A.2.B **C.** use mathematical calculations to assess quantitative relationships in data; and A.2.C **D.** evaluate experimental and engineering designs. A.2.D
The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The student is expected to: A.3	**A.** develop explanations and propose solutions supported by data and models consistent with scientific ideas, principles, and theories; A.3.A **B.** communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and A.3.B **C.** engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence. A.3.C
The student knows the contributions of scientists and recognizes the importance of scientific research and innovation on society. The student is expected to: A.4	**A.** analyze, evaluate, and critique scientific explanations and solutions by using empirical evidence, logical reasoning, and experimental and observational testing, so as to encourage critical thinking by the student; A.4.A **B.** relate the impact of past and current research on scientific thought and society, including research methodology, cost-benefit analysis, and contributions of diverse scientists as related to the content; and A.4.B **C.** research and explore resources such as museums, planetariums, observatories, libraries, professional organizations, private companies, online platforms, and mentors employed in a science, technology, engineering, and mathematics (STEM) field in order to investigate STEM careers. A.4.C
The student understands how the properties of water build the foundation of aquatic ecosystems. The student is expected to: A.5	**A.** describe how the shape and polarity of the water molecule make it a "universal solvent" in aquatic systems; A.5.A **B.** identify how aquatic ecosystems are affected by water's properties of adhesion, cohesion, surface tension, heat capacity, and thermal conductivity; and A.5.B **C.** explain how the density of water is critical for organisms in cold environments. A.5.C
Students know that aquatic environments are the product of interactions among Earth systems. The	**A.** identify key features and characteristics of atmospheric, geological, hydrological, and biological systems as they relate to aquatic environments; A.6.A

student is expected to: A.6	**B.** describe the interrelatedness of atmospheric, geological, hydrological, and biological systems in aquatic ecosystems, including positive and negative feedback loops; and A.6.B
	C. evaluate environmental data using technology such as maps, visualizations, satellite data, Global Positioning System (GPS), Geographic Information System (GIS), weather balloons, and buoys to model the interactions that affect aquatic ecosystems. A.6.C
The student knows about the interdependence and interactions that occur in aquatic environments. The student is expected to: A.7	**A.** identify how energy flows and matter cycles through both freshwater and marine aquatic systems, including food webs, chains, and pyramids; A.7.A
	B. identify biological, chemical, geological, and physical components of an aquatic life zone as they relate to the organisms in it; A.7.B
	C. identify variables that affect the solubility of carbon dioxide and oxygen in water; A.7.C
	D. evaluate factors affecting aquatic population cycles such as lunar cycles, temperature variations, hours of daylight, and predator-prey relationships; and A.7.D
	E. identify the interdependence of organisms in an aquatic environment such as in a pond, a river, a lake, an ocean, or an aquifer and the biosphere. A.7.E
The student conducts short-term and long-term studies on local aquatic environments. Local natural environments are to be preferred over artificial or virtual environments. The student is expected to: A.8	**A.** evaluate data over a period of time from an established aquatic environment documenting seasonal changes and the behavior of organisms; A.8.A
	B. collect and analyze pH, salinity, temperature, mineral content, nitrogen compounds, dissolved oxygen, and turbidity data periodically, starting with baseline measurements; and A.8.B
	C. use data from short-term or long-term studies to analyze interrelationships between producers, consumers, and decomposers in aquatic ecosystems. A.8.C
The student knows the role of cycles in an aquatic environment. The student is expected to: A.9	**A.** identify the role of carbon, nitrogen, water, and nutrient cycles in an aquatic environment, including upwellings and turnovers; A.9.A
	B. examine the interrelationships between aquatic systems and climate and weather, including El Niño and La Niña, currents, and hurricanes; and A.9.B
	C. explain how tidal cycles influence intertidal ecology. A.9.C
The student knows the origin and potential uses of fresh water. The	**A.** identify sources of water in a watershed, including rainfall, groundwater, and surface water; A.10.A
	B. identify factors that contribute to how water flows through a watershed; A.10.B

student is expected to: A.10	C. analyze water quantity and quality in a local watershed or aquifer; and A.10.C
	D. describe human uses of fresh water and how human freshwater use competes with that of other organisms. A.10.D
The student knows that geological phenomena and fluid dynamics affect aquatic systems. The student is expected to: A.11	A. examine basic principles of fluid dynamics, including hydrostatic pressure, density as a result of salinity, and buoyancy; A.11.A
	B. identify interrelationships between ocean currents, climates, and geologic features such as continental margins, active and passive margins, abyssal plains, island atolls, peninsulas, barrier islands, and hydrothermal vents; A.11.B
	C. explain how fluid dynamics causes upwelling and lake turnover; and A.11.C
	D. describe how erosion and deposition in river systems lead to formation of geologic features. A.11.D
The student understands the types of aquatic ecosystems. The student is expected to: A.12	A. differentiate among freshwater, brackish, and marine ecosystems; and A.12.A
	B. identify the major properties and components of different marine and freshwater life zones. A.12.B
The student knows environmental adaptations of aquatic organisms. The student is expected to: A.13	A. compare different traits in aquatic organisms using tools such as dichotomous keys; A.13.A
	B. describe how adaptations allow an organism to exist within an aquatic environment; and A.13.B
	C. compare adaptations of freshwater and marine organisms. A.13.C
The student understands how human activities impact aquatic environments. The student is expected to: A.14	A. analyze the cumulative impact of human population growth on an aquatic ecosystem; A.14.A
	B. predict effects of chemical, organic, physical, and thermal changes due to humans on the living and nonliving components of an aquatic ecosystem; A.14.B
	C. investigate the role of humans in unbalanced systems involving phenomena such as invasive species, fish farming, cultural eutrophication, or red tides; A.14.C
	D. analyze and discuss how human activities such as fishing, transportation, dams, and recreation influence aquatic environments; A.14.D
	E. describe the impact such as costs and benefits of various laws and policies such as The Endangered Species Act, right of capture laws, or Clean Water Act on aquatic systems; and A.14.E

F. **analyze the purpose and effectiveness of human efforts to restore aquatic ecosystems affected by human activities.** A.14.F