Mississippi Science

High School: Marine and Aquatic Science I

Adopted 2018

High School - Marine and Aquatic Science I

1. **Water Properties and Quality** MAQ.1

   1A. Students will develop an understanding of the unique physical and chemical properties of water and how those properties shape life on earth. MAQ.1A

   1. Characterize the physical and chemical properties of water, including specific heat, surface temperature, universal solvent, and hydrogen bonding between water molecules (i.e., cohesion/adhesion/capillary action). MAQ.1A.1
   2. Describe the role of water within biological systems (e.g., provides the medium necessary to allow for life processes such as protein synthesis, enzymatic reactions, and passive transport). MAQ.1A.2
   3. Diagram, utilizing digital or physical models, the water cycle and how it relates to the total amount of fresh water available to living things at any given time. MAQ.1A.3
   4. Collect, analyze, and communicate quantitative data that includes dissolved oxygen, pH, temperature, salinity, mineral content, nitrogen compounds, and turbidity from an aquatic environment (i.e., hydrometer, refractometer, Secchi disk, and chemical test kits). MAQ.1A.4
   5. Research, analyze, and communicate current technology and career opportunities available to collect this data on a global scale using CTD, buoy data, or satellites. MAQ.1A.5
   6. Enrichment: Use an engineering design process to reduce the effects of pollution in aquatic ecosystems (e.g., microplastics, garbage patches, oil spills, and eutrophication). Students will design a proposed solution based on current research and/or observations, and develop a model in order to test their design. Data from experimentation will be analyzed, organized graphically, and communicated to classmates to determine the effectiveness of the proposed solution. MAQ.1A.6

2. Fluid Dynamics MAQ.2

2A. Students will develop an understanding of the principles of fluid dynamics as it relates to both salt and freshwater systems. MAQ.2A

1. Characterize wave features and wave properties, including wavelength, period, wave speed, breakers, and constructive waves and their effects on shoreline communities (e.g., headlands, embayments, shoreline erosion, and deposition). MAQ.2A.1
2. Survey predictable patterns of tides (i.e., tidal period and range, diurnal, semidiurnal, mixed, spring, and neap tides) to correlate with moon phases in graphical form. MAQ.2A.2
3. Summarize principles related to currents (e.g., global wind patterns, Coriolis effect, Ekman spiral, surface, thermohaline, upwelling, downwelling, El Niño, La Niña, hurricanes, Barrier Island movement). MAQ.2A.3
4. Research, analyze, and communicate scientific arguments to support climate models that predict how global and regional climate change can affect Earth's systems (e.g., precipitation and temperature and their associated impacts on sea level, global ice volumes, and atmosphere and ocean composition). MAQ.2A.4
5. Distinguish among lentic and lotic water systems, including water flow, seasonal overturn, and watershed mapping. MAQ.2A.5

3. Geological Features MAQ.3

3A. Students will understand the principles of plate tectonics, sea floor spreading, and physical features of oceanic zones. MAQ.3A

1. Use geospatial data to analyze, explain, and communicate differences among the major geological features of specific aquatic ecosystems (e.g., plate tectonics, continental rise, continental slope, abyssal plain, trenches, sea mounts, island formation, and watersheds). MAQ.3A.1
2. Develop an understanding of plate tectonics to predict certain geological features (e.g., sea floor spreading, paleomagnetic measurements, and orogenesis). MAQ.3A.2
3. Classify zones of the ocean based on distance from shorelines (i.e., intertidal, neritic, oceanic, and benthic zones), temperature, and light availability (i.e., epipelagic, mesopelagic, bathypelagic, abyssopelagic, and hadopelagic). MAQ.3A.3
4. Classify zones of freshwater sources based on the velocity of current, depth, and temperature. MAQ.3A.4

4. Flora and Fauna MAQ.4

4A. Students will examine characteristics of specific aquatic ecosystems and the effects of human and natural phenomena on those ecosystems. MAQ.4A

1. Compare and contrast the unique biotic and abiotic characteristics of the following selected aquatic ecosystems: intertidal zone, wetlands/estuaries, coral reef, barrier islands, continental slope/shelf, abyss, rivers/streams/watersheds, and lakes/ponds. MAQ.4A.1
2. Recognize representative examples of plants and animals that would be specifically adapted to the aquatic ecosystems, and identify adaptations necessary to survive. MAQ.4A.2
3. Determine the niches within trophic levels in the aquatic ecosystems by creating food webs and researching the symbiotic relationships that exist. MAQ.4A.3
4. Research, analyze, and communicate the effects of urbanization and continued expansion by humans on the aquatic ecosystems' biodiversity (e.g., land use changes, erosion and sedimentation, over-fishing, invasive/exotic species, and pollution). MAQ.4A.4
5. Explore the importance of species diversity to the biological resources needed by human populations, including food (e.g., aquaculture and mariculture), medicine, and natural aesthetics. MAQ.4A.5
6. Research, analyze, and communicate the effects of natural phenomena (e.g., hurricanes, floods, drought, and sea-level rise) on the aquatic ecosystems. MAQ.4A.6
7. Research, analyze, and communicate which and in what capacity local, state, and federal regulatory agencies are involved in different aquatic ecosystems, including current environmental policies already in place (e.g., the Clean Water Act and the Endangered Species Act). Research should include, but is not limited to, how humans can preserve animal diversity through the use of habitat creation and conservation, research, legislation, medical and breeding programs, and management of genetic diversity at local and global levels. MAQ.4A.7
8. Enrichment: Choose an environmental issue that currently exists in one of the aquatic ecosystems and use an engineering design process to propose and develop a possible solution using scientific knowledge and best management practices (BMPs). Create an environmental action plan to include moral, legal, societal, political, and economic decisions that impact animal diversity in both the short and long term. Results from developed plans will be communicated with classmates. MAQ.4A.8