

Utah	Marine Science Standards	Essentials of Oceanography 13e
Standard MSCI.1.1	Develop and use models which use scale, proportion, and quantity to describe the Earth's oceans and the different marine zones.	Ch. 1.1 How Are Earth's Oceans Unique?; Ch. 3 Marine Provinces; Ch. 2 Plate Tectonics and the Ocean Floor; Ch. 12.5 Main Divisions of the Marine Environment
Standard MSCI.1.2	Plan and carry out an investigation to explain the unique properties, structure, and function of seawater when compared to freshwater. Emphasize the properties of temperature, polarity, solubility, salinity, density and how they change in the water column.	Ch. 5 Water and Seawater; Ch. 7.5 How Do Sea Ice and Icebergs Form?
Standard MSCI.1.3	Engage in argument based on evidence for how the patterns of sea water, tides, currents, waves, and weather affect the shoreline and influence the evolution, adaptations, and distributions of marine populations.	Ch. 6 Air–Sea Interaction; Ch. 7 Ocean Circulation; Ch. 8 Waves; Ch. 9 Tides; Ch. 10 Beaches, Shoreline Processes, and the Coastal Ocean; Ch. 12.4 How Are Marine Organisms Adapted to the Physical Conditions of the Ocean?; Ch. 15 Animals of the Benthic Environment; Ch. 14 Animals of the Pelagic Environment
Standard MSCI.2.1	Construct an explanation of how populations of organisms evolved (changed) over time as ocean ecosystems changed. Emphasize that the earliest life on Earth originated in the ocean.	Ch. 1.7 Did Life Begin in the Oceans?; Ch. 12.1 What Are Living Things, and How Are They Classified? (common ancestry, symbiosis, lateral gene transfer, coevolution); Ch. 12.4 How Are Marine Organisms Adapted to the Physical Conditions of the Ocean?; Ch. 15 Animals of the Benthic Environment; Ch. 16.4 What Changes Are Occurring in the Oceans as a Result of Global Warming?
Standard MSCI.2.2	Ask questions to analyze and interpret data for how matter and energy is used during photosynthesis and chemosynthesis in oceanic ecosystems. Emphasize the ocean zones in which photosynthesis and chemosynthesis are the primary mode of production in ocean organisms.	Ch. 13.1-13.4 primary productivity, photosynthesis, food webs; 15.4 Deep-Sea Hydrothermal Vent Biocommunities (chemosynthesis)
Standard MSCI.2.3	Analyze and interpret data about marine life from varying marine ecosystems to classify them into different marine phyla using structure and function, distinguishing characteristics, and adaptations.	Ch. 12.1-12.2 marine life classification; Ch. 14.4 What Characteristics Do Marine Mammals Possess?; Ch. 15 Animals of the Benthic Environment

Utah	Marine Science Standards	Essentials of Oceanography 13e
Standard MSCI.2.4	Develop and use models to analyze the flow of energy and cycling of matter in marine ecosystems. Examples of models could include food webs, trophic levels, and carbon exchange.	Ch. 13 Biological Productivity and Energy Transfer
Standard MSCI.2.5	Obtain, evaluate, and communicate information regarding the stability and change of relationships between biotic and abiotic factors in marine ecosystems. Examples of ecosystems could include estuaries, coral reefs, kelp forests, the open ocean, and the deep ocean.	Ch. 10.6 What Are the Characteristics and Types of Coastal Waters? (estuaries); Ch. 12.4 How Are Marine Organisms Adapted to the Physical Conditions of the Ocean?; Ch. 13.1 What Is Primary Productivity?; Ch. 13.4 How Are Energy and Nutrients Passed Along in Marine Ecosystems?; Ch. 15 Animals of the Benthic Environment
Standard MSCI.3.1	Ask questions to obtain, evaluate, and communicate information about the patterns that exist in the interactions between humans and the marine environment throughout history. Emphasize historical and modern motivations for oceanic exploration and research as well as the associated challenges and findings.	Ch 1.2 How Was Early Exploration of the Oceans Achieved?; Ch. 1.3 What Fields of Science Does Oceanography Include?; pp. 8-9 Students Sometimes Ask (deep sea exploration); Ch. 7.1 How Are Ocean Currents Measured?; Ch. 16.4 What Changes Are Occurring in the Oceans as a Result of Global Warming? (modern oceanographic monitoring and research)
Standard MSCI.3.2	Engage in argument based on evidence about how human activities may affect marine ecosystems. Examples of human activities could include the extraction of resources, transportation, and recreation.	Ch. 11 Marine Pollution; Ch. 13.5 What Issues Affect Marine Fisheries?; Ch. 16.2 Earth's Recent Climate Change: Is It Natural or Caused by Human Activities?; Ch. 16.3 What Causes the Atmosphere's Greenhouse Effect?; Ch. 16.4 What Changes Are Occurring in the Oceans as a Result of Global Warming?
Standard MSCI.3.3	Analyze and interpret data to investigate the causes and effects of climate change on the ocean and marine ecosystems. Examples of data to investigate could be sea level rise, thermal expansion, ocean acidification, ocean temperature, biomagnification of pollutants, ocean deoxygenation, and eutrophication.	Ch. 16 The Oceans and Climate Change

Utah	Marine Science Standards	Essentials of Oceanography 13e
Standard MSCI.3.4	Design a solution in the form of a sustainability plan that impacts individual, city, or regional contributions (changes), including Utah, to marine environmental systems. Define the problem, identify criteria and constraints, develop possible solutions using models, analyze data to make improvements from iteratively testing solutions, and optimize a solution.	Ch. 16.5 What Can Be Done to Reduce Greenhouse Gases?; Ch. 11.5 What Can You Do to Help Prevent Marine Pollution?; Ch. 13.5 What Issues Affect Marine Fisheries?