| Standard | Lesson 1 Case study through critical reading | Lesson 2 Exploration of sources and detection of CO2, carbon cycle | Lesson 3 Consider stakeholders and possible investigation | **Lesson 4** Plan a cohesive set of experiments | Lesson 5AExperiments and analysis  | Lesson 5BAnalyze online data, simulations or other evidence | Lesson 6Mock summit, presentation of findings development of network, possible solutions  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **1-h**. Although the ocean is large, it is finite and resources are limited. |  X |  X |   X  |  |   |  X |  X |
| 2-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. |  |  X |  |  |   |  X |  |
| **2-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. |   |  |    |  |   X |  |   |
| **3-a**. The ocean controls weather and climate by dominating the Earth’s energy, water and carbon systems. |   |  X |  |  |  |  X |  |
| **3-e**. The ocean dominates the Earth’s carbon cycle. Half the primary productivity on Earth takes place in the sunlit layers of the ocean and the ocean absorbs roughly half of all carbon dioxide added to the atmosphere. |  X |   X  |  |  |  |  X |  X |
| **3-f.** The ocean has had, and will continue to have, a significant influence on climate change by absorbing, storing, and moving heat, carbon and water. |  X |   X |   |  |   |   X |  X |
| **3-g**. Changes in the ocean’s circulation have produced large, abrupt changes in climate during the last 50,000 years. |  |  X |  |  |   |  X |  |
| **4-a**. Most of the oxygen in the atmosphere originally came from the activities of photosynthetic organisms in the ocean. |  X |  X |   X |  X |    X  |  X |    X |
| **5-a**. Ocean life ranges in size from the smallest virus to the largest animal that has lived on Earth, the blue whale. |  X |  |  X |  |   |  |  |
| **5-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. |  X |  |   X |  |   X |  X |  |
| **5-d**. Ocean biology provides many unique examples of life cycles, adaptations and important relationships among organisms (such as symbiosis, predator-prey dynamics and energy transfer) that do not occur on land. |   X  |   |   X  |  |   |  X |   X |
| **5-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 considered a desert. |  X |  X |   X |  |  X |  X |   X |
| **6-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. |  |  |   X  |  |   |  X |   X |
| **6-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. |  |  |   X  |  |    |   |  X |
| **6-c**. The ocean is a source of inspiration, recreation, rejuvenation and discovery. It is also an important element in the heritage of many cultures. |   |  |  X  |  |    |  |  X |
| **6-d**. Much of the world’s population lives in coastal areas. |  X  |   |  X  |  |   |   |  X |
| 6-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 (such as point source, non-point source, and noise pollution) and physical modifications (such as changes to beaches, shores and rivers). In addition, humans have removed most of the large vertebrates from the ocean. |  X |   X  |  X |  |   |   X |  X |
| 6-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. |  |  |   |  |   |   |  X |
| **7-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 submersibles. |  X |   |   X  |  |   |   X  |  X |
| **7-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. |  |  X |   |  |   X  |  X |  X |
| 7-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. |   |   |   X  |  X |   |   |   X  |

1. The Earth has one big ocean with many features.
2. The ocean and life in the ocean shape the features of the Earth.
3. The ocean is a major influence on weather and climate.
4. The ocean makes Earth habitable.
5. The ocean supports a great diversity of life and ecosystems.
6. The ocean and humans are inextricably interconnected.
7. The ocean is largely unexplored.