# **Oceans Discussion Guide (for use during or after reading)**

1. What is the ocean? Why is the ocean integral to our way of life on Earth? (What Is an Ocean?, p. 4-7)
   1. The ocean is made of salt water and covers about 70% of Earth’s surface. Oceans help maintain our planet’s temperature by absorbing heat from the sun. Oceans are also home to many plants and animals and provide countless others the resources they need to survive. For example, humans rely on oceans for medicine, food, jewelry, gas and oil, energy, transportation, and more! Approximately 80% of the world’s population lives within 60 miles of an ocean coast.
2. What do you notice and wonder about the major oceans and seas detailed on pages 8 and 9? (Major Oceans and Seas, p. 8-9)
   1. Students’ answers will likely vary. Guide the discussion toward students’ interests and encourage them to ask questions to help pique their interest and maintain engagement.
3. How can waves affect the shore? (The Shore, p. 10-13)
   1. The shore is located where the ocean and land meet. Waves crash into the shore, eventually creating a variety of land features. Powerful ocean waves can erode rock. To erode means to wear away at something. As waves hit the shore, they cause small pieces of rock to break away, thus changing the landscape. Ocean waves can create steep cliffs as well as cut caves this way. In addition, ocean waves pick up sediment, tiny pieces of sand and rock, as they move. Often, this sediment is moved from one area of the coast to another, sometimes creating new sandy features like a tombolo, a sand bar, a ridge, or even a lagoon.
4. How does Earth’s oceanic crust compare to its continental crust? Choose and describe at least one of the major features found on the ocean floor. (The Ocean Floor, p. 14-17)
   1. Earth’s surface layer, called its crust, is separated into massive portions called tectonic plates. Tectonic plates are made of both oceanic crust as well as continental crust. Continental crust involves all the rock on land (and even the same rock that extends partially into the ocean) and oceanic crust involves all the rock on the ocean floor. The land under the ocean looks quite similar to that above it, with tall mountains, deep valleys, and flat plains.
   2. Students’ responses about specific oceanic crust features may vary. Some may describe ridges, like the Mid-Atlantic Ridge, as features formed from heat within Earth warming the crust until it is flexible enough to move, rise, and form a mountain. Others may describe trenches, like the Mariana Trench, as narrow valleys formed from two plates moving toward each other with one eventually pushing underneath the other.
5. What are the four major zones scientists use to describe the ocean? What makes each layer unique? (Ocean Layers, p. 18-22)
   1. Scientists have divided the ocean into different layers, or zones, based on their depth and other characteristics.
   2. The topmost layer is called the sunlight zone. It is generally the warmest layer and contains most of the ocean’s plants and animals. The sunlight zone receives quite a lot of light and reaches from the surface to 660 feet deep.
   3. The second layer is the twilight zone. Almost no sunlight reaches this layer so almost no plants survive, given their need for sunlight to produce their own food. This zone reaches from 660 feet deep to 3,300 feet deep.
   4. The next layer is the midnight zone. Here, the pressure is 100-1,000 times greater than on the surface due to the weight of the water. The water temperatures in the midnight zone are just above freezing. This layer contains bioluminescent animals that have adapted to make their own light to survive the harsh conditions of the deep. The midnight zone reaches from 3,300 feet deep to about 20,000 feet deep.
   5. The final layer is known as the abyss. This is the deepest layer of the ocean and can reach over 33,000 feet deep! The abyss has been compared to a garbage dump as dead sea animals and plants eventually fall to its deep floor. The abyss can contain hydrothermal vents where warm water flows upwards from the ocean floor. Some animals like mussels and giant tubeworms live near these hydrothermal vents, but otherwise there is not much life in the abyss.
6. Some currents travel around the entire world. Describe how ocean water cycles in this way and why this is important. (Ocean Currents, p. 22-25)
   1. Some currents travel around the entire world. For example, a current begins in the chilly Arctic Ocean. Because some water freezes in the Arctic, leaving behind its salt, the surrounding water is much saltier, making it heavier and causing it to sink toward the sea floor. New water from the surface replaces this sinking water, creating a current. Changes in temperature and changes in water density, or heaviness, create these deep-ocean currents, which travel for 1,000 years to complete the massive loop across the planet. Cycling currents help spread nutrients throughout the ocean, helping animals to eat and survive.
7. What are waves and how are they formed? (Waves, p. 26-29)
   1. Some people think waves are water moving across the surface of the ocean, but this is not true! Waves are actually energy traveling through the water. Most waves are caused by blowing wind, but they can also be caused by storm surges, earthquakes, landslides, volcanic eruptions, and tides.
8. What role does gravity play in creating ocean tides? (Tides, p. 30-31)
   1. Gravity plays a major role in creating ocean tides. The moon’s gravity pulls on ocean waters, causing them to rise and fall. The area of Earth facing the moon and the area directly opposite the moon experience high tides while other parts of the world experience low tide. As Earth rotates, different areas experience the effects of the moon’s gravity, thus experiencing a variety of tides.
9. Describe the steps of the water cycle, including how water cycles around both Earth’s surface and its atmosphere. (The Water Cycle, p. 32-33)
   1. The water cycle is the constant movement of both fresh and salt water around Earth’s surface and atmosphere. First, the sun’s heat causes water on Earth to evaporate from the ocean, leaving salt behind. The ocean water is now in its gaseous state and is called water vapor. Cold air in the atmosphere causes the water vapor to change into its liquid form as tiny water droplets. These tiny water droplets then come together to form a cloud that releases water as rain or snow. That water lands on Earth, travels through rivers and streams or even such man-made structures as drainpipes and sewers, until it eventually flows back into the ocean to start the cycle once more.
10. What are some of the major threats to Earth’s oceans? Why are these concerning and what are some potential solutions? (Threats to the Ocean, p. 34-35)
    1. Human activity is putting the oceans at great risk! Overfishing affects the whole ocean food chain because other ocean animals rely on these fish for food. Humans pollute the oceans with plastics and other types of waste that some animals mistake for food and eat. In addition, human actions have contributed to global warming, causing ocean temperatures to rise. This creates other concerns, such as melting Arctic habitats or risks of coastal flooding. In order to protect our oceans from further harm, governments, businesses, and individuals must work to use less plastic, burn fewer fossil fuels, and be aware of how their choices affect the environment.