How Did the Oceans Form?

Most scientists agree that early Earth had no atmosphere. The belief is that the planet was molten liquid and didn't allow any gases to escape. Eventually Earth cooled enough for the crust to form. Much like today, all the volcanic activity taking place helped to release gases trapped within Earth's interior. Eventually all those gases began to accumulate as an early atmosphere. According to this theory, the ocean formed from the escaping water vapor and other gases that were released over millions of years.

After Earth’s surface had cooled to a temperature that was below the boiling point of water, rain began to fall. This rain continued to fall for hundreds of years, and as that water accumulated it began to form the oceans. Scientists believe that the development of the oceans led to the processes that allowed life to form. Carbon dioxide dissolved into the early oceans and provided a nitrogen rich habitat. Believe it or not, there was no oxygen in the early oceans. Although oxygen is essential to nearly every life form today, according to data found in rocks, the earliest life forms didn't use oxygen. Initially, bacteria was one of the only life forms on Earth. Eventually they learned how to photosynthesize and in doing so, began to create oxygen.

As the planet began to evolve and oxygen became present, many different environments and life forms began to emerge. After the atmosphere, oceans, and plant and animal life formed, organisms began to change through processes that still take place today.

When scientists study the oceans, they divide them into many different regions or zones based on the characteristics found there. They might look at distance from the shorelines, light that permeates the water, temperature, depth, density, or a number of other things to create these zones.

The basic division of the ocean involves the distinction between the water column and the bottom of the ocean floor. We use the word pelagic zone to describe the water because the Greek word *pelagikos* means sea. The bottom is known as the benthic zone. The Greek word *benthos* means depths of sea. We can further divide both the pelagic and benthic zone.
**How Did the Oceans Form?**

**Task #1**

<table>
<thead>
<tr>
<th>Most Important Ideas:</th>
<th>Vocabulary Words/Definitions:</th>
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**Picture Summary of the Text:**

**Comprehension Questions:**

1. Explain how Earth's early oceans first formed.

2. How do scientists decide how to determine the 'zones' of the ocean?

3. Describe, in detail, the most basic division of the ocean.
Ocean Zones

Scientists divide the ocean into two main realms, the benthic realm and the pelagic realm. The benthic realm is the region at the bottom of the ocean and includes the layers of sediment we consider the seafloor. This realm begins at the shoreline and continues downward along the continental shelf and then extends all the way to the abyssal plain at around 4,000 meters deep. The ocean floor is not flat but rather has mountains, canyons, trenches, and ridges. All the organisms that can survive in this realm vary as the pressure, salinity, temperature, light, and nutrients change as depth increases. The pelagic zone consists of all the ocean waters. This realm is neither near the bottom nor the shore but is rather the open part of the ocean. The pelagic zone can be subdivided into five different vertical zones depending on depth.

The photic zone of the open ocean extends from the surface level to 200 meters down, the only zone within the ocean with enough sunlight that penetrates through the water so that photosynthesis can occur. Many photosynthetic plants and animals live in this zone and they form the first link in the ocean food chain as primary producers. One of these organisms, phytoplankton, a free-floating plant, are the most abundant organisms on earth and produce more than 50% of all of Earth’s oxygen. Because phytoplankton are so abundant, this zone also supports up to 90% of all ocean life. Even though so much life takes place here, the photic zone is actually the smallest of the five ocean zones.

The next zone is the mesopelagic zone. This zone is also known as the twilight zone. While most of the sunlight doesn’t reach this zone of the ocean, and it is only dimly lit, many species of small organisms that live here migrate upwards to the photic zone at night. This migration is the largest migration that occurs on the planet in terms of biomass. The mesopelagic zone extends from 200 to up to 1000 meters deep.

Up next is the bathyal zone, also known as the midnight zone. This zone is cold and dark and it ranges from 1,000 to 4,000 meters deep. The water in this zone is only about 39°F and it marks the beginning of the aphotic, or no light zone. Many species that live in this zone do not have eyes since it is so dark. Instead, they’ve adapted transparent skin or even bioluminescence to survive. Many larger organisms such as whales, squid, and octopuses come to this zone to feed.

The abyssal zone extends from 4,000 to 6,000 meters deep and is perpetually dark and cold. Temperatures here are nearly freezing, and you can find hydrothermal vents here with boiling temperatures, lethal levels of hydrogen sulfide, and intense pressure that no human could survive. Even with all those seemingly inhospitable characteristics, there are creatures who make a life in this zone. Most organisms that live here are scavengers who rely on marine snow for nutrients. This snow consist of any organic matter that sinks to the abyssal zone from above. There is actually an abundance of life here, including tube worms, clams, and even giant squid.

Finally, the last and deepest zone is the hadal zone, extending from 6,000 meters to the very bottom of any point in the ocean. This zone is named after the underworld realm of Hades. Very few organisms can survive here, as food is sparse and the pressure is extreme. Some of the organisms that have adapted to life here include some species of worms, jellyfish, and sea cucumbers.

All of these zones are interconnected by currents and provide important habitats for a variety of organisms. Over 95% of the ocean remains unexplored, so there’s no telling what we’ll learn about the ocean in the future!
Complete the Ocean Zones chart after reading the article.

<table>
<thead>
<tr>
<th>Ocean Zone Name:</th>
<th>Defining Characteristics:</th>
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<tbody>
<tr>
<td>Surface</td>
<td>A</td>
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<td>B</td>
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<td>C</td>
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<tr>
<td></td>
<td>D</td>
</tr>
<tr>
<td>Trenches</td>
<td>E</td>
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</tbody>
</table>
1. Early Earth had no atmosphere
   a. True
   b. False

2. Which of the following helped to release the gases that created an early atmosphere on Earth?
   a. animal respiration
   b. volcanic activity
   c. evaporation

3. There was oxygen in Earth’s early oceans.
   a. true
   b. false

4. Which of the following determine the division of ocean zones?
   a. temperature
   b. depth
   c. sunlight
   d. all of the above

5. What is the term we give to the realm of open ocean water?
   a. benthic
   b. pelagic
   c. photic

6. What is the term we give to the ocean floor?
   a. benthic
   b. pelagic
   c. photic

7. The twilight zone is another name for the ___.
   a. photic zone
   b. mesopelagic zone
   c. bathyal zone

8. Most photosynthetic life is found in which zone?
   a. photic zone
   b. mesopelagic zone
   c. bathyal zone

9. Which zone extends from 1,000 to 4,000 meters deep?
   a. photic zone
   b. bathyal zone
   d. abyssal zone

10. The deepest zone is known as the ___.
    a. photic zone
    b. mesopelagic zone
    c. hadal zone

11. Most of the ocean has already been discovered.
    a. true
    b. false

12. All of the ocean zones are interconnected through currents.
    a. true
    b. false