

Name: _____

Period: ____ Date: _____

What is Ocean Acidification?

Use the following reading to answer the questions on the back of the sheet. Please answer in complete sentences.

Although less well-known than global warming, ocean acidification is another harmful consequence of increasing levels of carbon dioxide (CO₂) in the atmosphere. About one-quarter of the carbon dioxide released into the atmosphere through human activities (such as burning coal, oil, and gas) dissolves into the ocean. When carbon dioxide reacts with water (H₂O) in the ocean, the chemical reactions that take place lead to ocean acidification—the increase in acidity of seawater.

The pH scale is a measure of acidity that is related to the concentration of hydrogen ions (H⁺) in a substance. The more hydrogen ions in a substance, the lower its pH and the more acidic it is. Ocean acidification is the lowering of ocean pH. The ocean is not actually acidic—which is defined as having a pH less than 7—but the pH of the ocean is decreasing. When seawater and CO₂ mix together, they form carbonic acid (H₂CO₃). Like other acids, carbonic acid breaks apart in water and releases hydrogen ions. As a result, higher carbon dioxide levels increases the concentration of hydrogen ions and the ocean becomes more acidic.

Ocean conditions had been relatively stable for millions of years. However, since the Industrial Revolution, surface ocean pH has decreased by about 0.1 pH unit. That may not sound like a big difference, but because the pH scale is logarithmic, it is equal to about a 30 percent increase in acidity since the beginning of the 19th century. This rate of change is dramatic and will continue to worsen as humans continue to release carbon dioxide into the atmosphere. Scientists predict that ocean pH could drop by another 0.5 units by the end of the century. Such a significant change in ocean chemistry would undoubtedly have biological impacts.

Some organisms, such as certain algae and seagrasses, may benefit from increased CO₂ levels. However, some organisms will be negatively impacted. For example, the change in water chemistry affects how the brains of some fish process information and may alter their ability to avoid predators. Ocean acidification also makes it more difficult for some organisms to build shells. Organisms such as oysters, clams, corals, and plankton extract calcium ions (Ca²⁺) and carbonate ions (CO₃²⁻) from seawater to build shells and skeletons. The chemical reactions involving carbon dioxide and water generate hydrogen, carbonate, and bicarbonate ions; but the excess hydrogen ions in the water tend to bond with carbonate ions, making them unavailable to the organisms. Too many hydrogen ions in the water can even break apart existing calcium carbonate molecules and dissolve the existing shells of the animals.

Changes in ocean pH can affect the growth, reproduction, and behavior of ocean organisms, which will have cascading effects throughout the food web as well as impact jobs and economies that depend on them. Ecosystem dynamics are complicated, and it is difficult to predict the long-term consequences of ocean acidification, but scientists are resolutely trying to learn more about what changes may come.

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Questions.

1. How much of the carbon dioxide released into the atmosphere by human activities is dissolved into the ocean?
2. What are some examples of human activities that are increasing the release of carbon dioxide into the atmosphere?
3. What happens when carbon dioxide reacts with water in the ocean? How does this affect the pH of the ocean?
4. What do scientists predict will happen to the ocean pH by the end of the century?
5. Can any organisms benefit from increased levels of carbon dioxide?
6. What are some negative impacts of increased levels of carbon dioxide in the ocean?
7. How does ocean acidification affect organisms that build shells?
8. What happens to the excess hydrogen ions formed when carbon dioxide reacts with water?
9. How does this affect the existing shells of organisms?
10. Ocean acidification affects entire ecosystems. Explain this.