

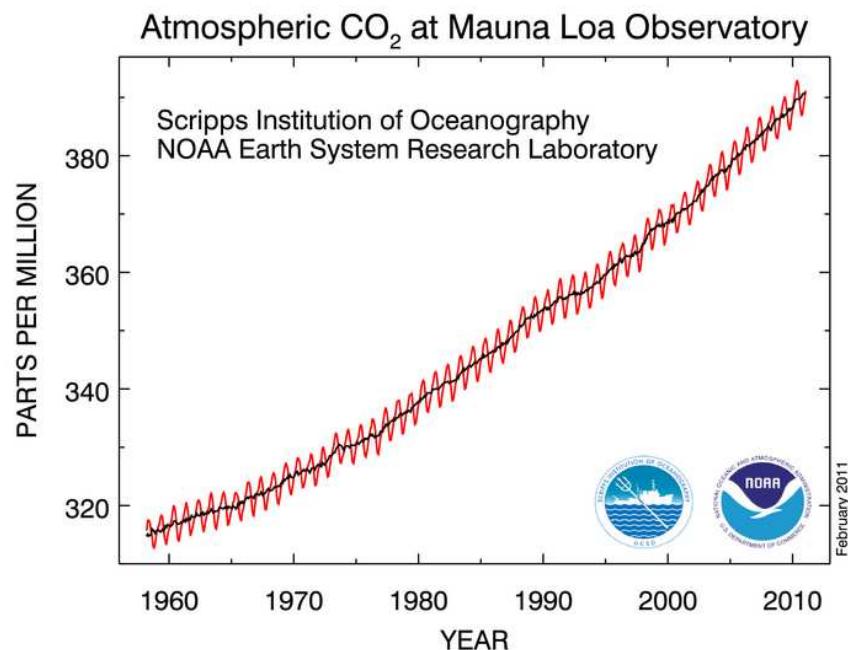
Classroom Activity

pH, CO₂, and Ocean Acidification

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Lesson Summary:

When carbon dioxide is dissolved in water it lowers the pH as carbonic acid is formed. Increases in carbon dioxide to our atmosphere threaten to change our climate through global warming, however evidence suggests that this increase in carbon dioxide can lead to a lowering of pH in our oceans, a process called **ocean acidification**. This lesson looks at the process, the factors involved in, and the effects of ocean acidification on marine organisms.



This graph shows the increase in atmospheric CO₂ levels in the last 50 years.

It is estimated that the ocean absorbs 25% of atmospheric carbon dioxide, leading to ocean acidification.

Key Concepts:

The major concepts in this lesson include

- pH
- Chemical change
- Ocean acidification
- The affects of a lower pH on aquatic creatures
- Climate change

Objectives:

- Demonstrate how pH in water is lowered with the addition of CO₂.
- Demonstrate the effects of a lower pH on the calcium carbonate exoskeletons or shells of marine animals.

Ocean Acidification

Part 1:

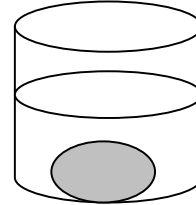
How can acids affect marine life?

Activity: Egg in Acetic Acid (a.k.a. Vinegar) Demonstration

This demonstration shows the effects of an acid on organisms.

Materials: Large Jar, Egg, and Vinegar (Acetic Acid)

Procedure:



Observe what happens when an egg is placed in a jar of vinegar and record your observations below.

Close the jar and leave it overnight.

Next day: Remove the egg from the acid and place it in a dish.

What happened to the **calcium carbonate** shell of the egg in acid?

An egg contains all of the chemicals (proteins and other materials) needed to make a chicken. What did the acid do to these materials after the eggshell has been broken down?

In a way, an egg is like many marine creatures. Its living material is covered with a carbonate shell. List as many sea creatures as you can think of that have **Calcium Carbonate** (a.k.a. limestone) shells or exoskeletons?

What could happen to the exoskeletons of these animals if the pH of the ocean were to be lowered?

What does a lower pH do to the proteins and other materials that make up living things?

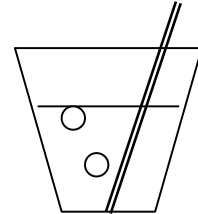
Ocean Acidification

Part 2:

How do the oceans become acidic?

Activity: Carbon Dioxide and pH in Water

Materials: water beaker or clear plastic cup drinking straw
Aquarium pH test kit solution crushed coral or seashells



Procedure:

Pour about 50 ml of water to a clear plastic cup or beaker

Next, add a few drops of pH indicator solution (from an aquarium pH test kit) to the water and mix it with a straw.

Record the color and pH of the solution. color: _____ the pH is _____

Slowly!!! exhale through the straw into the water with pH indicator solution until you notice a color change?

Describe the color change of the solution

What is the new pH of the solution _____

What gas are you adding to the solution as you exhale? _____

What does the addition of carbon dioxide gas do to the pH of water?

This is "acidification."

When CO₂ is added to water it forms Carbonic Acid (H₂CO₃)... *(do the math)*



Carbonic Acid

Add some crushed coral or seashells to this solution and swirl it around slowly for several minutes. (Eventually you will notice a color change).

What is happening to the pH of the solution as the coral or seashells are added ?

What compound are these exoskeletons?

What process used by plants can remove carbon dioxide from water?

Ocean Acidification

Part 3:

Discussion

What is ocean acidification?

What is causing our oceans to become more acidic?

What are the reasons for the increasing levels of CO₂ to our environment?

Describe how the addition of carbon dioxide can lower the pH of the seawater?
