OSTEOPOROSIS OF THE SEA

This lesson plan developed by:

Overview:
Our oceans absorb about a quarter of the carbon dioxide humans release into the atmosphere every year. When that excess carbon dioxide dissolves into the ocean, it can change the chemistry of the water, causing the oceans to become more acidic. Ocean acidification can negatively impact certain marine organisms and the ocean food web. Students will conduct an experiment to see the effects of increased acidity on certain species.

Materials:
Per group of students:

- 3 small glass jars or cups
- Tap water
- Carbonated water
- White vinegar
- pH strips (buy at pet or pool store)
- Shells, piece of dead coral, urchin test (skeleton) or chicken bones

Duration:
1 hour over a 24 hour period to take multiple observations

Physical Activity:
Moderate

Background:
As the oceans absorb excess carbon dioxide from the atmosphere, scientists have observed that the ocean is becoming more acidic. This change in chemistry can be harmful to some animals

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found in our oceans, including shellfish, sea urchins, corals and some species of plankton (ex. pteropods and coccolithophores). Many marine organisms use calcium carbonate to form their shells and skeleton. As carbon dioxide dissolves into the water, a series of chemical reactions occur resulting in the increased concentration of hydrogen ions. This increase causes the marine water to become more acidic and reduces the amount of carbonate ions available for organisms to use to build and maintain their shells and skeletons. Ocean acidification can negatively impact ocean food webs that rely on specific calcifying plankton species and important ecosystems, including shellfish beds and coral reefs.

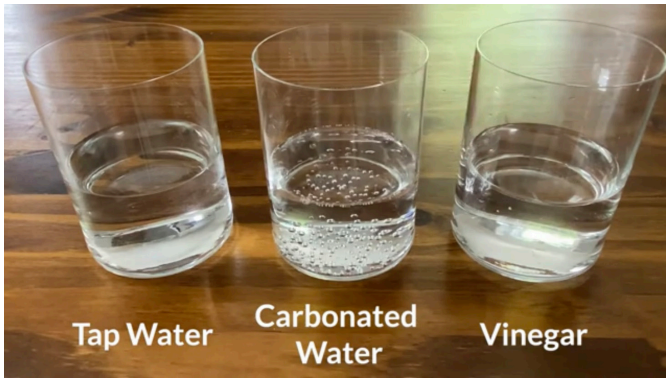
Activity:

Part 1: Introduction

1. Ask the whole group the following questions:
   - What is ocean acidification?
   - What causes ocean acidification?
   - What are some of the impacts of ocean acidification on ocean animals?
2. Discuss pH, which is a scientific measure of the acidity or basicity of a liquid. A pH of 7 is considered neutral. Acidic solutions, such as vinegar or lemon juice, have a pH of less than 7. The more acidic a solution is, the lower the pH number. Basic solutions, such as milk or baking soda dissolved in water, have a pH greater than 7. Ocean water is normally slightly basic. Prior to the Industrial Revolution, the average ocean pH was about 8.2. Today the average ocean pH is about 8.1 (becoming more acidic).

Part 2: Test Different Liquids

1. Fill one small jar with tap water, another jar with carbonated water, and the final jar with white vinegar.



2. Guess what the pH of each liquid will be and share why. Remember, to make carbonated water, carbon dioxide is bubbled in, similar to the oceans absorbing carbon dioxide.
3. Use the pH strips to measure the pH of all three liquids and record results.
4. Choose an item to test. To vary the experiment, educators may instruct groups of students to test different items in the liquids. For example, one group test shells, while another group tests urchin skeleton.
5. Hypothesize what will happen to the items when they are immersed in each liquid.

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6. Record initial observation once the items are immersed in the liquids.
7. Record observations every 30 minutes for two hours, and if possible, record observations after 24 hours.

Discussion:

You have now shown the impact of acidic waters on calcifying organisms. Ask the whole group the following questions:

- What happened to the items in the different liquids? Which liquid had the greatest impact? Why?
- What would happen if shellfish were no longer able to make their shell or coral reefs weren't able to grow?
- What are some human activities that contribute to ocean acidification?
- What are ways we can reduce our carbon emissions?

Additional Resources:

To learn more about the activity, check out our Osteoporosis of the Sea "how to" video.

Ocean Literacy Principles:

Ocean literacy is an understanding of the ocean's influence on us, and our impact on the ocean. There are seven Ocean Literacy Essential Principles that all people of our blue planet should have an opportunity to learn and understand. This activity touches upon the following Essential Principles:

1. Earth has one big ocean with many features
3. The ocean is a major influence on weather and climate
5. The ocean supports a great diversity of life and ecosystems
6. The ocean and humans are inextricably interconnected

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