

# Investigating the Effect of Increasing Carbon-Dioxide Concentrations on Sea Animals

## Overview

Students will understand how the increasing levels of carbon-dioxide in oceans affect shelled marine animals. They will carry out a student-developed investigation on how increasing ocean acidification affects these animals.

## Objectives

The objective of this lesson is for students to assess how increasing levels of atmospheric CO<sub>2</sub> affect marine organisms. In addition, they will devise an experiment to test the effects of ocean acidification on shelled marine organisms and detail their investigation in a one-page summary.

## Lesson Preparation

- Prior to the lesson, the students should read about the carbon cycle and how CO<sub>2</sub> dissolves into the ocean and affects the pH of the water. Valuable resources for conveying information about ocean acidification can be found on this NOAA site.
- Students can also complete this short lesson on Our Acidifying Ocean by themselves. This site includes excellent visualizations and opportunities for students to interact with data.
- The teacher may need to review the components of **experimental design** with the class.
- Students should be reminded that scientific research can be carried out in their surroundings. Students in locations proximal to bodies of water should be made aware that their research on this topic is relevant and should be shared with the community. All students can carry out scientific research.

### Details

-  Lesson
-  Arctic
-  Download, Share, and Remix
-  High school and Up

### Materials

Treatments: seltzer water (high CO<sub>2</sub>, low pH), fresh water (neutral), seawater (alkaline)  
pH test strips  
Shells  
Beakers  
Electric balance or triple beam balance  
Access to computers with Microsoft Excel

### Standards

#### Overview of National Standards

#### ESS3.D: Global Climate Change

Through computer simulations and other studies,

## Procedure

1. After reading about the effects of increased CO<sub>2</sub> levels in the ocean, the teacher will scaffold questions for students about devising means to test the effects on shelled marine organisms.
2. As a group, the students can provide possible hypotheses.
3. The teacher can set up a prototype of the experiment. There will be 3 beakers labeled with the treatment. The pH of each liquid should be measured and recorded. Shells of the same mass will be put in each beaker.
4. The teacher will then solicit possible means of measuring the effect of the acidic solution on the chalk. (For example, my students chose to see how shells, after soaking in the solutions for two days, held up under increasing weights put on them. This group of students weighed the textbook (1 pound) and saw how many textbooks each treated shell could support.)
5. Students will be given the materials and assistance to devise their own inquiry. Some possible means of testing the effects include comparing the masses or strength of the shells after soaking in the different solutions.
6. If the school is close to beaches with shells, students can gather similar types of shells and identify the species. Students can investigate more about the shelled marine species to evaluate the effects of lower pH in the water.

## Extension

Students can test the pH of nearby waterways. Researchers from nearby Universities or from organizations such as the Chesapeake Bay Foundation can visit the classroom and inform students of the effects of increasing CO<sub>2</sub> levels on shelled marine animals. Students can also share the results of their own experiments with scientists from nearby Universities and environmental organizations.

## Resources

<https://www.pmel.noaa.gov/co2/story/Ocean+Acidification>  
<http://i2sea.stanford.edu/AcidOcean/AcidOcean.htm>

## Assessment

important discoveries are still being made about how the ocean, the atmosphere, and the biosphere interact and are modified in response to human activities.

### State of Virginia Standards

#### VA Earth 10 C, E

The student will investigate and understand that oceans are complex, interactive physical, chemical, and biological systems and are subject to long- and short-term variations. Key concepts include C) systems interactions; E) economic and public policy issues concerning the oceans

#### VA Biology 8 D

The student will investigate and understand dynamic equilibria within populations, communities, and ecosystems.

Key concepts include D) the effects of natural events and human activities on ecosystems

Students will be assessed by creating a one-page poster about their experiment.

## **Author/Credits**

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