

# Off Base

**Title:** Off Base

**Grade Level:** High school

**Source:** NOAA

## Curriculum Materials

Objectives:

- Students will be able to define pH.
- Students will be able to define a buffer and explain in general terms the carbonate buffer system of seawater.
- Students will be able to explain Le Chatelier's Principle and will be able to predict how the carbonate buffer system of seawater will respond to a change in concentration of hydrogen ions.
- Students will be able to identify how an increase in atmospheric carbon dioxide might affect the pH of the ocean and will be able to discuss how this alteration in pH might affect biological organisms.

Materials:

- Copies of Ocean Acidification Inquiry Guide; one copy for each student group
- (Optional) Copies of Ocean Acidification: A Summary for Policymakers from the Second Symposium on the Ocean in a High-CO<sub>2</sub> World (<http://www.ocean-acidification.net/OAdocs/SPM-Iorezv2.pdf>)
- Protective goggles and gloves; one set for each student and one for the teacher
- 100 ml glass beaker; one for each student group
- 100 ml graduated cylinder; one cylinder may be shared by several student groups, but have separate cylinders for distilled water and seawater
- 500 ml glass beaker
- 2 - 1 liter beakers or Erlenmeyer flasks for mixing solutions
- Glass stirring rod; one for each student group
- Sodium hydroxide pellets, approximately 50 grams (see Learning Procedure Step 1)
- Solid citric acid (to neutralize sodium hydroxide spills); approximate 450 grams
- Distilled water; approximately 150 ml for each student group, plus 1.5 liters for making solutions (see Learning Procedure Step 1)
- Artificial seawater; approximately 150 ml for each student group, plus approximately 250 ml for demonstration
- pH test paper, wide range; one roll for each student group
- Dilute acetic acid solution in dropper bottles; one bottle containing approximately 50 ml for each student group (see Learning Procedure Step 1)
- 0.1 M sodium hydroxide solution in dropper bottles; one bottle containing approximately 50 ml for each student group (see Learning Procedure Step 1)
- Marker board, overhead projector with transparencies, or digital equivalent

Description:

This activity explores the phenomenon of ocean acidification, why it is happening, and what factors into the rate of decrease in oceanic pH. Students will do background research on the subject, and conduct hands-on measurements of changes in pH caused by acetic acid and sodium hydroxide in simulated sea water. The context of this lesson is coral and its health relative to oceanic acidity, but the overall lesson can be applied to New England species that use calcium carbonate, as well as the overall impact of more acidic surroundings on aquatic organisms.

State Framework relevance: