

## **Ocean Acidification and Its Effects on Organisms**

### **Background:**

As humans put more and more CO<sub>2</sub> into the atmosphere, the ocean is able to take up a lot of what we have already released. While people in the past believed our oceans had an unlimited capacity to absorb whatever we put into them, we have since realized that this is not the case. With such massive inputs of carbon dioxide into the atmosphere, and thus into the ocean, we are starting to see the consequences of our actions.

The oceans are becoming more and more acidic, which is a problem for the many organisms that utilize calcium carbonate for their shells and/or skeletons. They will either start to dissolve (calcium carbonate coral skeletons) or they will be unable to or severely limited in their ability to build such structures. This lesson plan looks at what happens to calcium carbonate “shells” when exposed to environments of varying pH (acidic, neutral, basic).

### **Objectives:**

1. Students will demonstrate the consequences of an increase in acidity in the world's oceans on the numerous organisms that use calcium carbonate.
2. Students will make the connection that an increase in dissolved CO<sub>2</sub> will change the pH of the solution, making it more acidic.
3. Students will also learn that sea water is better able to withstand changes in pH than fresh water because of sea water's carbonate buffering system.

### **Time:**

One class period

### **Materials:**

2-3 pieces of chalk per group OR enough chalk dust for your class

Small cups: 4-6 per group

pH paper

2-3 graduated cylinders

Some kind of acidic liquid - Lemon/lime juice, Vinegar, Carbonated beverage of your choice

Distilled water - tap water if distilled water is unavailable

Some kind of basic liquid – ammonia, detergent dissolved in some water

Small scale for weighing chalk before and after experiment

Data sheet

Paper towels

### **Methods:**

\*\*Have students prepare hypotheses for what they think will happen to the chalk in each experiment. Will it dissolve away, will it get larger, will it stay the same size/weight?

1. Pass out 2-3 pieces of chalk to each group. Or, if using chalk dust, give each group 2-3 tablespoons.
2. Have students label 2 cups "control." Pour 25 mL of tap water into each cup, then measure the pH of the water and record on data sheet.
3. Have students label one cup "experiment 1." Pour 25 mL of tap water into that cup and measure the pH. Record on data sheet.
4. Have students label one cup "experiment 2." Pour 25 mL of tap water into that cup and measure the pH. Record on data sheet.
5. Before putting a piece of chalk into each of the four cups, weigh the chalk on the scale. Record on data sheet. There should be 4-6 weights since there will be 4-6 pieces of chalk making their way into cups (depends on how many experimental cups you want to do).
6. Set aside one of the "control" cups and the cup labeled "experiment 2" for later.
7. Using one control cup and the "experiment 1" cup, place a piece of chalk into each and record observations, if any. Measure the pH and record on data sheet.
8. Measure out 25 mL of your acidic liquid of choice. Pour into "experiment 1" and record observations, if any. Measure the pH and record on data sheet.
9. Using the second control cup and the "experiment 2" cup, place a piece of chalk into each and record observations, if any. Measure the pH and record on data sheet.
10. Measure out 25 mL of basic liquid. Pour into "experiment 2" and record observations, if any. Measure the pH and record on data sheet.
11. Let your chalk sit for 10-15 minutes.
12. After time is up, take out the chalk from "experiment 1," blot dry with paper towel and weigh. Record on data sheet.
13. Take out the chalk from the control for experiment 1, blot dry with paper towel and weigh. Record on data sheet.
14. Take out the chalk from "experiment 2," blot dry with paper towel and weigh. Record on data sheet.
15. Take out the chalk from the control for experiment 2, blot dry with paper towel and weigh. Record on data sheet.

**Discussion Questions:**

1. What happened in each experiment? What did the chalk do? Did it fizz? Did it just sit there?
2. Were your hypotheses supported by your data? Why or why not?
3. What do you think is happening? If your chalk fizzed, why do you think it did that?

## DATA SHEET

### Ocean Acidification and its Effects on Organisms

	Control 1	Control 2	Experiment 1	Experiment 2
<b>Chalk weight</b>				
Before activity				
After activity				
<b>pH</b>				
Initial				
After chalk addition				
After addition of acid				
After addition of base				
After waiting 10-15 min.				

#### Hypothesis:

What will happen to the chalk in each experimental treatment? Will it dissolve away, will it get larger, will it stay the same size/weight?