



Cabrillo Marine Aquarium Lesson Plan

Grade Level: Eighth Grade

Title: Ocean Acidification Experiment

Objective: Students will test, observe, record and make conclusions on how acidity affects marine life.

California Science Standards: 8th: 5a, 5b, 5e, 6a, 9a-c

Time to Complete: 60 minutes

Materials Provided by CMA Ocean Discovery Kits: *Worksheet: Ocean Acidification Experiment Datasheet*, pH Probe, Shell Fragments, Marine Life Affected by Ocean Acidification Specimen Display

Materials Provided by Teacher:

- small cups (5 per **group**)
- paper towels
- copies of datasheet (1 per **group**)
- graduated cylinder (1 per **group**)
- tap water
- lemon/lime juice or distilled vinegar
- baking soda solution (mix 15 teaspoons to 1 quart tap water)
- carbonated soda
- pH test strips or red cabbage juice pH testing solution (optional)
- eyedropper (optional)
- water from a local source such as a river, pond, ocean, rain, etc.(optional)

Vocabulary: Global warming, greenhouse gas, anthropogenic, ocean acidification, pH, carbonic acid, dissociation, carbonate, bicarbonate, fossil fuel

Teacher Preparation:

If you would like to use cabbage juice instead the pH probe, prepare the solution as follows: (from *Cabbages and Chemistry*, Lawrence Hall of Science)

1. Chop and boil red cabbage.
2. Drain the liquid through a sieve to filter out the cabbage.
3. The liquid should be a red-purple-bluish color. This liquid is at about pH 7. (The exact color you get depends on the pH of the water.)
4. You can find color images for red cabbage pH indicator colors on-line, or use this scale:

Red Cabbage pH Indicator Colors	
pH	Color
2	Red
4	Purple
6	Violet
8	Blue
10	Blue-Green
12	Greenish Yellow

Setup the following materials for each group:

1. 4 or 5 cups per group (depending on whether or not you will be using water collected from a local waterway in your neighborhood)
2. Shell fragments (4 or 5 per group)
3. 1 graduated cylinder (if using)
4. paper towels

You could set-up a location in the classroom where students can measure out 25 mL of each solution (tap water, distilled vinegar, baking soda solution, carbonated beverage) and have students label cups appropriately on their own or distribute the cups already labeled and filled with solution.

Lesson Outline: Introduce “ocean acidification” to the students and how it could impact marine life. Students then observe what happens to the shells of marine organisms in different solutions of varying pH (acidic, neutral, basic).

Lesson Procedures:

1. Show students the specimens labeled Marine Life Affected by Ocean Acidification and ask them what all these creatures have in common.
2. Share with the students that one important thing all these ocean animals have in common is that they have shells made of calcium carbonate.
3. Explain to the students that we will be taking a closer look at the ocean and how a changing climate and changing ocean chemistry might affect life in the ocean.
4. Introduce the Ocean Acidification Experiment to the students, pass out datasheets and equipment to each group.
5. Have students make predictions about what they think will happen when they place the shell fragments into each of the solutions. Then have them place each of their shell fragments into the solution, one at a time, and record any initial observations they notice as they placed the chalk into the solution.
6. Let shell fragments sit for 10-15 minutes and record any observations throughout this time.

7. While waiting and observing the shell fragments, have students use the pH probe, dip a piece of pH paper, or add 1 dropper full of cabbage juice to each sample starting with the tap water.
8. Record the results on the datasheet.
9. Students should notice that each solution has a different pH. They also may have noticed that each solution produced a varying degree of fizz when the shell fragments were added (for example the vinegar should have produced the most “fizz” when a shell fragment was added).

Lesson Wrap-Up:

1. Discuss with the class how a more acidic ocean could impact shelled organisms in the ocean.
2. Discuss what we can do about ocean acidification. Discuss with them that combating acidification requires reducing CO₂ emissions (from cars and factories), reducing carbon footprints, and improving the health of the oceans. Creating marine protected areas (or national parks for the ocean) and stopping destructive fishing practices would increase the ability of marine ecosystems to withstand acidification. For example, evidence suggests that coral reefs in protected ocean reserves are less affected by global threats such as ocean acidification. Overall, the same strategies needed to reduce carbon emissions on land can also help slow these changes in the ocean.

Lesson Extensions:

1. This is a great way to visually show the change in acidity of water as CO₂ is dissolved in it. Using bromothymol blue as an indicator of the PH of water, simply use straws to blow into the water in a glass flask with a small opening. As you blow, the water turns from blue to green to yellow as the CO₂ from your breath dissolves in the water and makes it more acidic.
2. Watch Ocean acidification video from COSEE Now
<http://coseenow.net/blog/2010/12/ocean-acidification/>

References:

- COSEE NOW
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