

# Ocean Acidification: a hypothesis-testing lab activity

Adapted from the lab by Hawai'i Institute of Marine Biology (HIMB)

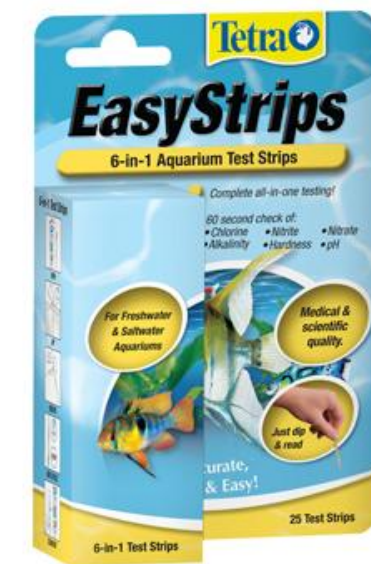
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## Objective:

- Observe changes in pH due to carbon dioxide absorption in water
- Formulate a hypothesis about the effect of acidification on submerged calcareous materials and water composition.

## Materials:

- Vernier pH sensor with data acquisition laptop
- Ocean water, tap water, de-ionized water
- Drinking straws, stopwatch, mortar & pestle
- A variety of beakers
- Water hardness test strips
- Calcium carbonate materials:
  - Chalk
  - Mussel and clam shells
  - Ground aragonite (from pet store)
  - Egg shells



## Procedure:

### Part I: Calibration

Students calibrate and practice using the pH meters.

### Part II: Buffering capacity of water

- Students observe the initial pH and hardness of three types of water: Tap water, De-ionized water, and Ocean water.
- Students blow through a straw to introduce CO<sub>2</sub> to the three types of water.
- Students observe the resulting change in hardness and pH.

### Part III: Hypothesis testing about CaCO<sub>3</sub> dissolution

- Students pose a hypothesis about the effect of one parameter on the change in pH or hardness. Popular parameters that students looked at included:
  - CaCO<sub>3</sub> particle size
  - Incubation time
  - Type of CaCO<sub>3</sub> material
- Students develop and perform a controlled experiment
- Students produce a formal lab write-up

### Acknowledgements:

This lab closely follows the protocol set forth by HIMB:

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Available online at:

<http://www2.hawaii.edu/~himbed/forms/HIMB-Ocean-Acidification-Lab.pdf>



Students introducing CO<sub>2</sub> via drinking straws into various mixtures of water and calcium carbonate

## Lessons Learned:

1. Mixing Trader Joe's "sea salt" in water DOES NOT create adequate ocean water!
2. Students used an average of 14 hardness test strips each! MUCH more than I anticipated.
3. Most groups posed hypotheses regarding the CaCO<sub>3</sub> particle size, and used chalk.
4. The digital pH sensors were not terribly robust or trustworthy. Just measuring pH of water proved a bit challenging. Part I is an important part of lab.
5. Explicit instructions about the guidelines, format, and expectations of the lab write-up were very helpful. Lab reports were of surprisingly high quality.
6. This lab was a great success. It was thoroughly enjoyed by the students, and they demonstrated mastery of the concepts and methods.