

Part 1: Eggs-amine the Changes

Shells serve as a protective structure for many marine and terrestrial organisms. Acidic oceans create a hostile environment for marine species with calcium carbonate skeletons and shells. To test the impacts of lowered pH (increased acidity) on calcium carbonate shells, gather these supplies for an at-home experiment:

Supplies:

- 2 eggs
- 2 glasses or cups of the same size
- Water
- Vinegar
- Sharpie or paper and pen (for labeling)



Step 1: Note the appearance and texture of both eggs initially. Write a few descriptive words below.

Step 2: Fill one glass with vinegar and one glass with water. Label each glass- either with Sharpie directly on the cup (as seen in the picture) or on a separate piece of paper next to each cup.

Step 3: Place one egg in the glass of water and one egg in the glass of vinegar. Leave both eggs submerged for at least a full day. Note the date and time you submerged the eggs below.

Date:

Time:

While you wait, answer these questions:

1. Do you see any initial activity in either sample after the eggs were put in? (ex. color change, bubbles, etc.)

2. What do you predict will occur to each egg as more time passes?



Step 4: After time has passed, remove both eggs (Note: Vinegar is acidic. You may choose to wear gloves when removing the egg in vinegar.) and answer these observational questions:

1. Are the eggs similar or different in their appearance and texture compared to the beginning (what you described in step 1)? How so?
2. What do you think caused any changes that occurred? (Note: Tap water is neutral and vinegar is an acidic liquid.)
3. Eggshells are about 95% calcium carbonate. What do these results potentially tell us about organisms with calcium carbonate skeletons and shells in acidic oceans?

This activity allowed you to see firsthand the effects of acidification on calcifying organisms (those with calcium carbonate skeletons or shells). When exposed to vinegar (an acidic liquid), the calcified eggshell produces CO₂ bubbles as it gradually dissolves. The shells and skeletons of live, marine calcifying organisms can be affected in the same way as ocean acidification becomes more and more severe.

Bonus activity! Next time you visit the beach, find a couple of (unoccupied) shells and test them out in the same way.

Part 2: Impacts and Initiatives Along the West Coast of the U.S.

Read the following New York Times article and answer the questions below:

<https://www.nytimes.com/2019/12/16/climate/california-ocean-acidifying.html>

1. How does the rate of ocean acidification in California's coastal waters compare to the rest of the world?
2. Why did Dr. Osborne choose to study foraminifera in order to observe ocean acidification trends? How did the foraminifera shells from the California Current Ecosystem change through time? Does this correlate with what you observed in the egg experiment? (Dr. Osborne's original study can be found [here](#))



3. In an earlier study mentioned in the article, how did changes in CO₂ levels (pre-industrial vs. 2100) impact immature shellfish? How do you think this might impact California's fisheries and the nation's seafood production? (The original study can be found [here](#))



