



Calcium Carbonate Calamity [ME]

Adapted from UNCW MarineQuest

Grades: 9-12

Time: 45 minutes to 1 hour

Goals: To use deductive reasoning to understand how acidification of the world's oceans can affect species that produce calcium carbonate exoskeletons.

Objectives:

Students will be able to: identify marine species that create calcium carbonate exoskeletons; understand the chemical reactions caused by acidification; and deduce what could happen to these species if the acidification process was increased.

Materials:

- Microscopes
- Petri dishes
- Small cups
- Vinegar
- Distilled or spring water
- Small seashells
- Pieces of coral
- Crab shells
- White paper
- Pencils or pens

Procedures:

1. Pre-Activity (introduction): Begin with a basic chemistry explanation of acids and bases and pH. Elaborate on how dissolving carbon dioxide will produce a higher concentration of hydrogen ions, thus decreasing the pH. This will have a negative effect on species that react to a lower pH (more acidic). Give human examples of how acids affect our own bodies in our stomachs and with reflux.
2. Activity: Divide the class into pairs or groups of three (depending on how many microscopes you have available). Pass out the petri dishes, small cups, vinegar, and water. Have the students create three solutions of vinegar and water: one of 1/3 vinegar and 2/3 water, one of 2/3 vinegar and 1/3 water, and one of all vinegar. Pass out the small shells and pieces of coral and have the students place them in three separate petri dishes. Carefully pour the first solution into the first petri dish and watch what happens with the naked eye. Then take a look under the microscope and sketch how the exoskeletons react to the acid in the vinegar. Do the same for the other two solutions.



3. Post-Activity (review): Have the students discuss their results as a class. What happened to the shells and coral pieces at higher concentrations of acidic vinegar? Correlate these results to the ocean and the increase in carbon dioxide, lower pH, and acidification of these exoskeletons.

Key Words:

Ocean acidification
pH

Exoskeleton
Acidic

Calcium Carbonate
Alkaline

Background Information:

Mollusks, crustaceans, and corals all produce an exoskeleton made of calcium carbonate. When calcium that is naturally found in saltwater reacts with carbon from the atmosphere, it produces calcium carbonate and assists with the growth of these shells. As these species grow, they build another layer of shell on top of the old or they molt and another layer forms.

When carbon dioxide combines with saltwater, carbonic acid is produced, causing ocean acidification. This process also depletes the carbonate ions in ocean water. As ocean water becomes acidic, exoskeletons dissolve and become brittle. The higher the concentration of acid, the quicker the dissolution of calcium carbonate will be.

High concentrations of carbon dioxide are found in greenhouse gases, which are emitted into the atmosphere. These gases mix with the water cycle to produce acid rain. When precipitation falls on the oceans, these acids dissolve in saltwater, changing the pH from alkaline to acidic. As these acids dissolve exoskeletons, these species become highly susceptible to predation. As acids leech into their body systems, their organs will no longer function properly.

