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Per. 1
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Ocean Acidification

IV: Co2 Concentration/ Type of Water
DV: Shell Strength/Color of Water

Introduction

The increasing amount of carbon emissions into the atmosphere is being absorbed by the oceans, resulting in elevated pH levels. The rise in industries has caused many global issues. The results are oceans becoming acidic and global climate change. Ocean acidity can pose a problem to marine ecosystems because shelled organisms won't be able to create their shells if the water is too acidic. And since the shelled organisms are the centers of many food webs, the whole ecosystem will struggle due to the lack of food.

Carbonate mixed with hydrogen ions creates carbonic acid (H2CO3). This carbonic acid can disintegrate shells by preventing calcium carbonate, which is the main component in sea creatures shells. Weaker shells means a lower chance of survival. These shellfish are an important part of the marine ecosystems diet. This will carry over to affect other organisms that don't depend on them for food because the water will become too harsh for them to live in.

Experimental Question

Ocean Acidification is becoming a global issue. In order to prove its harm, two labs testing the effects of Co2 in water to mimic the earth oceanic environments.The first lab tests the rate of acidification in different waters while the second tests the effects of long term exposure to acids of shells.

The first lab will be conducted on 4 various kinds of water, or the independent variables: hot, cold, tap, and control. These 4 types will be poured into beakers of equal volume and supplemented with 4 drops of color indicator, which measures CO2 levels in water. The beakers will be covered in saran wrap, and a straw will be inserted. A person will blow into the straw for 2 minutes, and the color will be recorded every 30 seconds.

The second lab will be comprised of two shells: one submerged in vinegar or any other weak acid, and one in plain sea water. These shells will first be weighed and compared to 2 control shells that will be supplied prior. After 30 minutes of submersion (with observations recorded during the 15 minute mark), both shells will be taken out of their beakers and weighed again, then they will be tested for durability by stacking books on them until they shatter. This durability test will also be repeated for the control shells. The number of books used will be recorded, and weights will be compared for all shells.

What gas are you blowing into the water?

We are exhaling Co2 into the water

What happens to the gas when you blow it in the water?

The water becomes more acidic

How are you measuring change during the lab?

We are comparing the color of the pH in the water to the color indicator sheet

What does measuring the pH of the water tell us?

The acidity of the water, with 1 being the most acidic and 14 being alkaline

After studying the reactions above, how do you think the carbonic acid will affect the pH of salt water?

I think the carbonic acid will raise the pH of the water

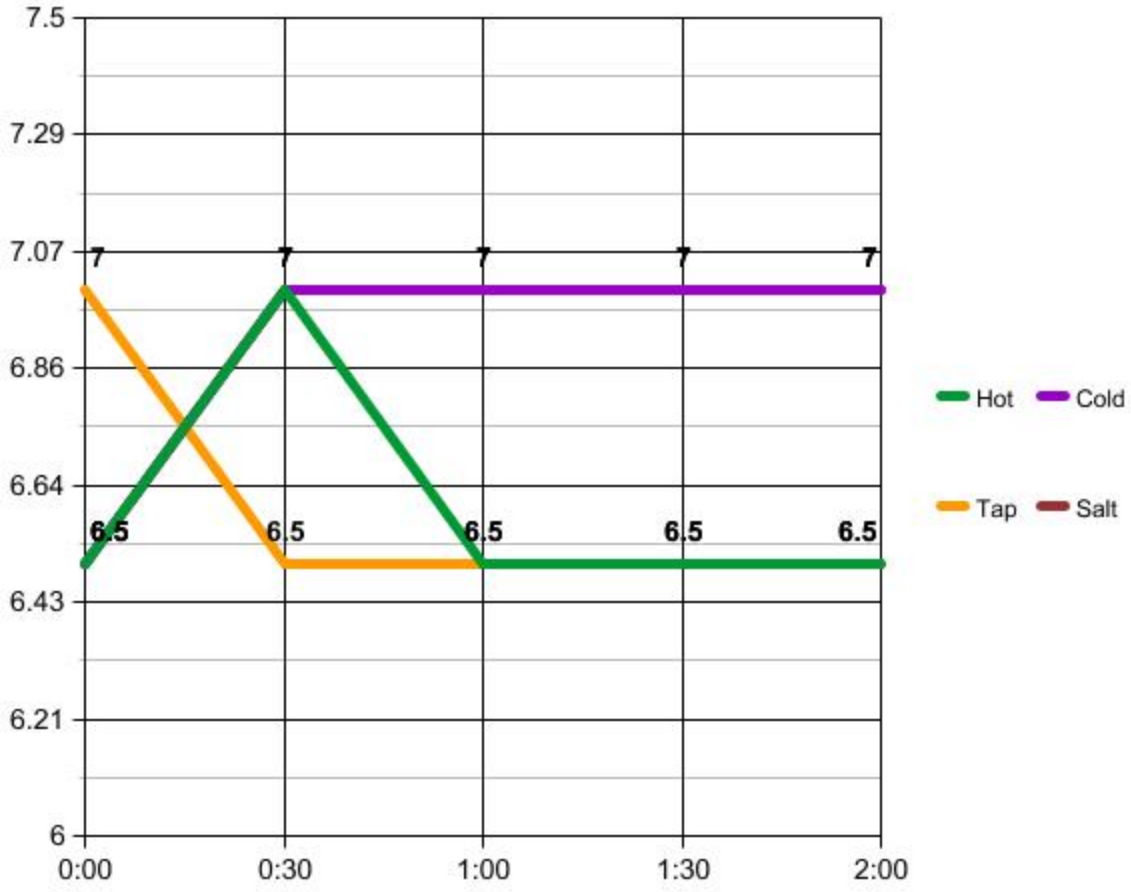
Hypothesis

If Co2 is released into the various waters, then the salt water will absorb the most.

Protocol

The test will be performed on the 4 various types of water: hot, cold, tap, and the control. 4 100ml beakers will be used to hold the four types of water. 3 drops of pH indicators will be dropped in. The beakers will be covered in saran wrap and a straw will be placed inside. Someone will blow for 2 minutes, will another person checking the color and pH level of the water every 30 seconds.

Property	0:00	0:30	1:00	1:30	2:00
Hot-pH	6.5	7	6.5	6.5	6.5
Color	Light Green	Light Green	Light Green	Light Green	Light Green
Cold-pH	6.5	7	7	7	7
Color	Light Blue	Light Green	Light Green	Light Green	Light Green
Tap-pH	7	6.5	6.5	6.5	6.5
Color	Light Green	Light Green	Light Green	Light Green	Light Green
Control-pH	6.5	7	7	7	7
Color	Light Blue	Green	Green	Green	Green



As you blew through the straw, what were you adding to the water and how did that change the pH?

As I blew, I released Co2 into the water, which mixed with the hydrogen ions to create carbonic acid.

What did the universal indicator tell us about the water?

The universal indicator showed us the acidity of the water.

What does this tell us about the effects of carbonic acid in ocean water?

This shows us that Co2 does make the oceans more acidic

Based on the results of your experimental protocol, which factors affect the pH of the water most, temperature or salt?

From the overwhelming results, I would say temperature plays a much bigger role compared to salt.

Conclusion

Based on the results, my hypothesis was incorrect. The salt water did not absorb the most co2, but the hot did. Although my hypothesis was disapproved, I learned that temperature affects the amount of carbon that can be absorbed, especially in hotter climates such as places near the equator.

Shells Lab

How do organisms make their shells? What are shells made of?

Organisms make their calcium carbonate shells by collecting the nearby calcium carbonate

What do you expect to happen to the shell in an acidic solution such as vinegar?

I expect the shell to start to dissolve and become weak

What are sources of carbon dioxide and which of these sources are most likely to affect ocean pH?

Sources like industrial sites are likely to affect ocean pH

Hypothesis

If the shells are placed in the liquids, then the shell in vinegar will be weaker.

Protocol

This lab will be comprised of two shells: one that will be submerged in vinegar, and one that will remain in plain sea water. These shells will first be weighed and compared to 2 control shells that will be supplied prior. After 30 minutes of submersion (with observations recorded at the 0 and 15 minute mark), both shells will be taken out of their beakers and weighed again, then they will be tested for durability by stacking books onto them until they shatter. This durability test will also be repeated for the control shells, which may be performed during the trials. The number of books used will be recorded, and listed weights will be compared for all shells.

Shell	Observations	Initial Mass	Final Mass	Difference
Sea water	white underside, ugly, shiny	2.0g	2.1g	.1g
Vinegar	black,greyish, shiny	2.1g	2.1g	0g
High	flakey,brown, uneven, ugly	2.1g	1.4g	.7g
Low	ugly very flakey deep brown	2.2g	1.4g	.8g

control-15 books

experiment-14 books

high-1 book

low-5 books

observation @ 0- vinegar shell starts to bubble

observation @ 15- intense bubbling, control is sitting plainly

When you immersed the shells in vinegar how did you know that a reaction was happening?

I knew something was happening because the vinegar started to bubble around the shell

How did observing the shell in vinegar relate to how animals are affected by lower pH of ocean water?

The shells mimic zooplankton because their shells are made of calcium carbonate to build shells such as the ones we tested.

How would a shelled organism be affected by a lower pH of ocean water?

Shells protect them, and their shells cannot form when pH is too low.

Does it cost the animal energy to rebuild or repair their shells?

Yes energy is used to repair the shells

Conclusion

My hypothesis was proven true in our small sample size. The vinegar did indeed dissolve the shells more than the salt water. However, I noticed that the control actually gained weight, most likely from the calcium carbonate in the salt water. This lab proved that lower pH levels in the oceans do have a effect on shelled organisms.