



GirlsGotSTEAM Workshop: Ocean Acidification Exploration

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| Program: | Ocean Acidification Exploration |
| Age Range: | 10-14 |
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| Description: | A demonstration and experiment duo designed to explain to students what ocean acidification is, why it is important, help connect concepts such as pH and carbon sinks, and encourage them to think about ways to reduce their own carbon footprint. Come educate to help save the environment! |

NOTE TO INSTRUCTOR: This lesson plan is an OUTLINE - use it as you will to execute your workshop. Feel free to add and remove material as needed. Attached is a PowerPoint and a packet (SciNotebook) for your student to complete. The SciNotebook includes material that should be taught and explained throughout the day.

The PowerPoint will include pictures, additional information, and instructions. It **SHOULD NOT** be the primary resource to run the workshop. Please refer to the lesson plans for detailed instructions. If you have any questions, comments, or concerns about any information in this workshop, please email girlsgotsteamorl@gmail.com.

| Time | Objective | Component |
|---|--|--|
| Block 1: Introduction | Students should be introduced to what ocean acidification is, and what a carbon sink is. | Activity 1: Introduction Activity 2: SciNotebook Activity |
| Block 2: Experiments! | Students will learn about pH, the effect of CO ₂ on water visually, and the effect of lowering the ocean pH on mollusks and other shelled organisms. | Activity 1: Dry Ice Demonstration Activity 2: Let's Talk Clams and Chalk |
| Block 3: Reflect/Answer Questions | Students should end by reflecting on the concepts they've learned and connect with the subject matter personally by thinking of ways they can reduce their own carbon footprint. | Activity 1: Discussion Activity 2: Review Activity 3: SciNotebook Wrap Up |



Materials for Ocean Acidification Lab and Demonstration

NOTE TO INSTRUCTOR: There are two parts to this lab that produce the same conclusion. It is designed so that students can make better conclusions based on the material. However, you are free to choose one and the same information will be conveyed, just skip certain parts of the PowerPoint and SciNotebook!

Two Beakers • Plastic Containers (1 for each student present) • Straws • Bromothymol Blue Indicator Solution • Dry Ice Chunks • Chalk • Vinegar • Salt • Freshwater (distilled) • Pencils (for SciNotebooks)

Block 1: Introduction

• Activity 1: Introduction

- To begin, it is vital for the kids to understand what ocean acidification is and its importance.
 - Ocean acidification occurs when the pH of seawater is lowered, and this occurs when CO₂ is absorbed by the ocean. With rising CO₂ emissions, the ocean is taking in more and more CO₂; this means the ocean is becoming more acidic. This change in pH level has severe effects on marine ecosystems (i.e. mollusk/shell degradation and plankton in coral reefs dying off). See PowerPoint for diagrams and explanations.
 - Explain the term “carbon sink.” See PowerPoint.
 - “A carbon sink is any reservoir, natural or otherwise, that absorbs more carbon than it releases, and thereby lowers the concentration of CO₂ from the atmosphere.” It absorbs more carbon than releases it.
 - Examples of carbon sink include plants (vegetation), soil, and the ocean.
- Explain that it dissolves shells!
 - Have students *name as many sea animals that live in shells*
 - Ask “*What would happen if these animals weren’t around anymore?*”
 - Make sure to facilitate fun and thought-provoking discussion!

• Activity 2: SciNotebook

- Have your students answer the following questions in their SciNotebooks:
 - Name three things that are considered “acidic.”
 - What will happen if the ocean becomes too acidic?
 - Where does CO₂ come from? (answer in PowerPoint)
 - Describe what a carbon sink is in your own words.
- Once every student completes this task, go over the answers. Spend time with the first two questions, and use examples such as “stomach acid” and “citrus.”
- Complete and color the carbon sink diagram given in SciNotebook.



Block 2: Experiments! (Dry Ice and Chalk Demonstrations)

• Activity 1: Dry Ice Demonstration

- Explain that this demonstration is supposed to show how the ocean's acidity levels have changed overtime.
 - Refer to the PowerPoint for information on how the Industrial Revolution and factories have increased the amount of CO₂ in the air.
- Explain that one beaker will hold clean water, which represents the ocean before there was extra CO₂ from factories. Explain that in the other beaker, there will be a chunk of dry ice which will represent the ocean now.
 - Ask students why they think the dry ice beaker represents the ocean "now." Once they discuss, refer to the PowerPoint and explain that dry ice is the solid form of CO₂, just like ice cubes are the solid form of H₂O.
- Add the Bromothymol Blue Indicator Solution to both beakers. With the given pH color guide in PowerPoint in view, use the straw to blow bubbles into the water without the dry ice until it starts to change to a yellowish-green color. This represents the ocean without excess CO₂. Then, move to the dry ice and start to blow bubbles until it changes to a bright yellow color. This represents the ocean with excess CO₂ from increased carbon emissions.
- Ask the students to raise their hands and tell which number on the pH spectrum they think corresponds to each beaker. Explain that the brighter yellow is more acidic.
- Call the students up in pairs and let them repeat the experiment; let them add different amounts of dry ice to see how the acidity changes.
- Have them recreate the color of the two beakers in their SciNotebooks.

• Activity 2: Let's Talk Clams and Chalk

- Let's now remind students of the animals involved in ocean acidification. Ask them to recall what animals they thought would be the most affected and what would happen to the rest of the ecosystem. Explain that when the ocean becomes acidic, it can break down shells because they are made of calcium carbonate.
 - Refer to the PowerPoint on the chemical composition of calcium. Discuss examples of things that contain calcium!
- Explain that chalk is also made of calcium carbonate. The chalk can represent real clam shells!
- Have the students go in groups of three. Each student will receive a piece of chalk, and each group will receive three plastic containers.
 - For every group, fill the plastic containers with water, vinegar, and saltwater, but do not tell the groups which is which!
- Have each student write down the length of their chalk in the Sci Notebook. Have each student place their piece of chalk in one of the containers, so each group has one piece of chalk in every container!
- Let the containers sit overnight! In the morning, have the corresponding label on each container: "freshwater," "vinegar" or "saltwater."



- Have each group measure and record their chalk length again and come up with why they think the chalk deteriorated. Show the PowerPoint slide with the acidity levels of fresh water, vinegar and saltwater.

Block 3: Reflect

• Activity 1: Discussion

- The class should discuss how the demonstration and the chalk experiment was similar.
 - Have the class draw a connection between the acidic vinegar and the dry ice. Do they both contain high levels of CO₂? What would happen if you blew into vinegar with the indicator present? (*Instructors can do this with caution!)
- Bring this new information back to the shells of clams. Have the class discuss why ocean acidification is dangerous, and what they can do to lessen their carbon output.
- **NOTE TO INSTRUCTOR:** Discussion should be interactive and detailed. Please ensure that students understand the objective of this workshop.

• Activity 2: Review

- Instructors should reiterate the key learning points of this workshop by asking students questions:
 - What is something we learned today?
 - Why is it important to understand ocean acidification?
 - What animals are affected by pH decreasing in the ocean?
 - What causes ocean acidification and how can you do your part to fix it?

• Activity 3: SciNotebook

- Fill out the reflection space in the SciNotebook.
- Since the workshop is coming to an end, please ensure that all the students' SciNotebooks are completed!

We hope your students will enjoy learning about ocean acidification and how they can help! Thank you so much for using GirlsGotSTEAM's resources for your workshop - our team would be beyond happy to provide you with more free and enjoyable lesson plans in the future! For any questions, comments or concerns, please email girlsgotsteamorl@gmail.com or DM us @girlsgotsteam on Instagram!