



## Let's See Ocean Acidification

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[conservationtales.com/reefs](http://conservationtales.com/reefs)



**Grade Levels:** 3-8

**Timeline:** 30 min prep + 40 min lab activity

### Materials:

#### Making pH Indicator

- Red cabbage
- Pan to boil cabbage
- Bottle or jar to store indicator

#### Observing Acidification

- Flask, beaker, or other clear container
- Tap Water (you can add salt if you wish!)
- Red cabbage pH indicator
- Eye droppers or plastic pipettes
- Soda straws
- Plastic spoons
- Baking soda solution – about 1 tsp baking soda in about 200 ml of water
- Vinegar solution – about 1 tsp of vinegar in about 200 ml of water

### NGSS Alignment

This activity addresses the following standards from the Next Generation Science Standards: **Disciplinary Core Ideas:**

**LS2.C: Ecosystem Dynamics, Functioning & Resilience**

**PS1.B: Chemical Reactions**

**ESS3.C: Human Impacts on Earth Systems**

**Science & Engineering Practices:** Planning and carrying out investigations; Analyzing and interpreting data  
Constructing explanations

#### Cross-Cutting Concepts:

Patterns

Cause & Effect

Energy & Matter: Flows cycles and conservation

**Driving Question:** *Can CO<sub>2</sub> in the air really make water acidic?*

### Objectives:

- I can test the pH of a liquid using an acid-base indicator.
- I can demonstrate the effect of CO<sub>2</sub> on pH of water.
- I can explain how CO<sub>2</sub> causes ocean acidification.

### Background Information

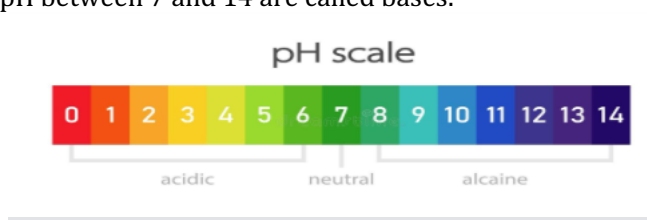
Corals in the Caribbean are disappearing, and one of the reasons is ocean acidification. In this activity, you will see what happens to the pH of water when CO<sub>2</sub> is added using materials you can find in your kitchen or at the grocery store.

#### **Background:**

You have probably heard about the impact of carbon dioxide (CO<sub>2</sub>), but did you know that the amount of CO<sub>2</sub> in the air increases, the oceans become more acidic? It can be hard to imagine how an invisible gas can have that kind of impact on our oceans, but you can do a simple experiment to see how that change is happening!

Changes in pH (the way we measure acidity) in the ocean can change the availability of important minerals used by corals, oysters, snails, and many other animals to make their shells. When the ocean becomes more acidic, the acids created when CO<sub>2</sub> mixes with water makes it much harder for corals to absorb calcium carbonate from the ocean. Calcium carbonate is the chemical that corals use to build their shells. As a result, animals that make calcium carbonate shells have a harder time growing when the ocean becomes too acidic.

**pH Scale:** To help us understand, let's talk about pH. The pH of a solution, like sea water, measures how many Hydrogen ions are available to react with other chemicals. Acids have a pH measuring between 1 and 7. Substance with a pH between 7 and 14 are called bases.



**Making an Acid-Base Indicator:** In order to observe a change in pH, we need to use a chemical called an “indicator.” There are many indicators that change color in acids or bases. One of these is simple to make at home and safe to use!

For this experiment, you or your teacher can make an indicator by boiling some red cabbage. You can find red cabbage at the grocery store. Cut up some pieces of cabbage, put them in a clean container, cover the cabbage with water and boil it on a stove or hotplate. You can make a darker indicator by removing the used cabbage leaves and adding more fresh cabbage to the boiling water.

After you boil the cabbage, drain the liquid into another container and let it cool. Put a cap on it to keep other chemicals from mixing with the indicator dye. It is a good idea to label the container and store it in a refrigerator.

### Experiment

Let's use the indicator dye you made to see what happens to the pH of water when you add CO<sub>2</sub>!

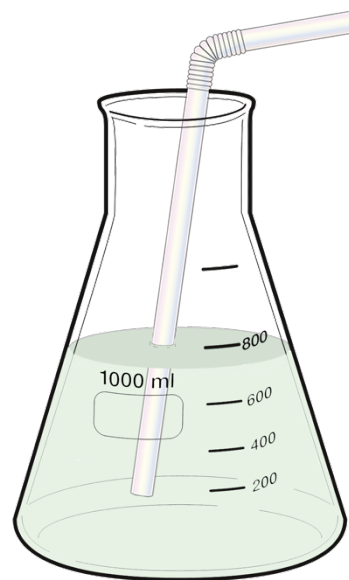
YOU will be the source of CO<sub>2</sub>. Each breath you exhale contains CO<sub>2</sub>, so you'll add CO<sub>2</sub> to a container of water using a straw.

- 1) Fill a flask, beaker or clear jar or glass about 2/3 full with water. (Optional: If you want to simulate ocean water, add some salt.)
- 2) Add enough red cabbage indicator to make the color easy to see.
- 3) Make sure the solution is neutral. The indicator will turn green when it is neutral. If it is blue, add a few drops of diluted vinegar, and swirl the flask to mix it. Add a couple of drops at a time until it turns green. If the indicator is yellow, add a couple of drops of baking soda solution, swirling to mix the solution.

Make an observation:

What color does the indicator turn when you add vinegar? (acid) –

What color does the indicator turn when you add baking soda? (base) –



## Ocean Acidification

- 4) When the solution is green, you are ready to see what happens when you add CO<sub>2</sub>!

Use a soda straw to gently blow bubbles into the water. Your breath contains CO<sub>2</sub>. Keep blowing until the color changes.

- 5) Record an observation: What color did the solution turn? \_\_\_\_\_

### Making Inferences:

- A. What chemical do you think caused the color to change when you blew bubbles?
- B. Does the color change show that the solution became more acidic or more basic? Why do you think this?
- C. For middle school or high school learners: After you blew bubbles, the solution contained a chemical called carbonic acid (H<sub>2</sub>CO<sub>3</sub>) Try to write a chemical equation showing the reaction that created this carbonic acid.

**Going Deeper:** The diagram below is from Conservation Tales: Coral Reef Ecosystems. Look at the diagram and see if you can help explain why acidification of the ocean is a problem for corals. Then discuss what might be some causes of increasing CO<sub>2</sub> levels. You can also learn more by watching a video about coral reef restoration at:

<https://www.youtube.com/watch?v=F4nq24jOHEc&list=PPSV>

