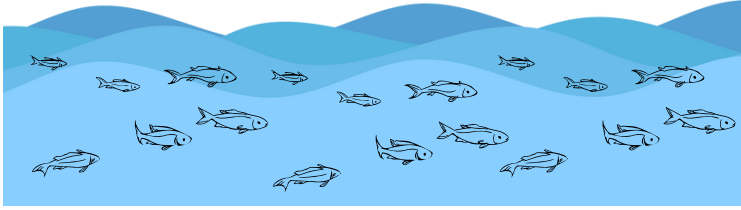


ACTIVITY 4: INVESTIGATING OCEAN ACIDIFICATION



The purpose of this activity is for students to model the impact that increased levels of carbon dioxide have on ocean waters.

Materials:

- Clear plastic cups (or 500mL beakers)
- Plastic straws
- A block of dry ice (optional)
- Litmus paper (or a digital pH probe)
- Universal indicator solution
- Graduated cylinder or a 1 tsp spoon
- Ski gloves or oven mitts
- Distilled water

First, inform students that they will be working with their groups to model the impact that increased levels of carbon dioxide have on ocean acidity. If they do not already have the concept of a system/surroundings construct for examining situations in science, discuss what a system (both closed and open). Draw particle diagrams (e.g., squares with dots inside and outside of the square) to illustrate. After reaching group understanding, distribute the materials for the experiment to groups.

Some variations of this experiment can be done—either by the same group or by separate groups—to see their effects on the acidity:

- Exhaling through a straw into the water (can be done by one or more students)
- Dissolving dry ice (solid carbon dioxide) in the water

Next, have students execute the steps of the following procedure:

Procedure:

1. Fill two containers with equal amounts of water and add 5mL (e.g., 1tsp) of indicator
2. Take the pH of the water in both containers.
3. In one container, leave the water alone
4. Add carbon dioxide to the other container using dry ice or by blowing bubbles into it

Method 1: blow bubbles through the straw continuously for 3-5 minutes. (Note: students may need to take a break so they don't get lightheaded)

Method 2: add 2-3 pebble sized pieces of dry ice to the water and let it bubble for 3-5 minutes

Finally, take the pH of both containers again and note any differences in appearance.

Then, provide students with chart paper and markers—or large dry-erase boards and whiteboard markers—to summarize their group's data and experimental results. Be sure to have them include a particle diagram to show what is happening at the smallest possible level in the system at the beginning and ending times.

Last, engage the students in a “board meeting” where all students sit/stand in a circle facing one another with their chart paper or dry-erase boards facing inward for all to see to discuss their collective results. Facilitate this discussion by selecting and sequencing groups to share about their data and answer probing questions so that any of the following discussion goals are accomplished:

- How did the pH of the two containers compare before and later? The color?
- Note: if you had any groups use dry ice, also compare the results of dry ice vs. straws
- Discuss the implications of this experiment. How did increased carbon dioxide levels contribute to pH / color change in the system? What do our particle diagrams illustrate is happening?
- How does this microsystem model what is happening at the scale of our planet with increased carbon emissions?
- What are the potential consequences of carbon emissions on ocean acidification?
- What is the main thing that needs to happen in order to combat ocean acidification?

Extensions to this activity include: brainstorming ways to reduce carbon emissions, exploring in more detail the chemistry behind what's happening during ocean acidification, or discussing the article in Activity 5.