OREGON MARINE SCIENTIST AND EDUCATOR ALLIANCE

Ocean Acidification - Class Demonstrations

By William Johnson, Heidi Wacker, and Tom Calvanese

Instructor: Perform the following demonstrations for the whole class while students fill out a data sheet recording their observations.

DEMO: Observe a carbonated beverage before and after it is opened. While the soda is in the bottle, CO2 is dissolved in the liquid under pressure. When the pressure is released (the cap removed), some of the CO2 gas is released as bubbles. Adding Mentos candy to the soda helps breaks the bonds between CO2 and water forming even more bubbles. Summary: A lot of CO2 gas can be dissolved in a liquid.

DEMO: Ask students hold their breath and observe what happens. Eventually, they will want to stop holding their breath. The body can detect pH changes in the blood due to excess CO2, and triggers exhalation. Summary: Excess CO2 has effects on living systems.

DEMO: Into a beaker of seawater, mix in several drops of bromothymol blue and observe that the liquid turns blue. Bubble CO2 gas into this liquid and observe that the liquid turns yellow. What does the color change indicate? Summary: The addition of CO2 to a liquid causes a chemical change.

DEMO: Into a beaker of seawater with bromothymol blue, add vinegar and observe that the liquid turns yellow. Then shift the liquid back to blue by adding ammonia. Elicit students' prior knowledge that vinegar is acidic and ammonia is basic, which will help them postulate that bromothymol blue is a pH indicator. Blue indicates alkaline and yellow indicates acid. Consider testing this hypothesis by observing the effect on the indicator of other known acids (e.g., lemon juice) or bases. With this information, what conclusions can be drawn about the effect of CO2 on pH? Summary: The addition of CO2 to a liquid lowers the pH of the liquid.

DEMO: Use baking soda and vinegar to generate CO2 gas in a 1000 mL beaker. Pour the CO2 gas over a candle flame. The candle will smother and the smoke will be pushed down and follow the path of the gas. Summary: CO2 is heavier than air and has pressure.

DEMO: Put an Alka Seltzer tablet and a little water in a film canister and seal the canister. Turn the canister lid-side down. The canister will be propelled away and ricochet off the ceiling.
Summary: CO2 has pressure.

SUPPLEMENTARY MATERIALS – Class Demos

Bill: I'm shifting the color of bromothymol blue back and forth with common household acids and bases.

Bubbling CO2 in seawater and bromothymol blue, after a few minutes the indicator shifts to gold. The seawater has become acidic.

Pouring carbon dioxide. Shows that carbon dioxide gas is "heavier" than air and has more pressure than air. The candle is smothered. The flame and smoke are pushed down as the carbon dioxide is poured.