

Ocean Acidification Toy Car Activity

Activity Developed by:

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Activity Overview

This activity visually demonstrates how CO₂ gas (from sources like internal combustion engines) can change seawater chemistry and make it more acidic. The bromothymol blue pH indicator changes from a blue color in normal seawater (pH ~8) to yellow as it gets more acidic (pH <7) when you bubble in CO₂.

Bromothymol Blue (pH indicator)	
<i>below pH</i>	<i>above pH</i>
6.0	7.6
6.0	7.6

Materials Needed

- Seawater
- Container for seawater (2 gallons is enough for quite a few demos)
- Bromothymol Blue indicator dye solution (sodium salt, 0.04% w/v)
- Clear beaker for reaction (a 500 ml plastic Erlenmeyer flask reduces spills when bubbling and won't break)
- CO₂ bike tire inflator (can find this at REI [<http://www.rei.com/product/696553/genuine-innovations-ultraflate-plus-bike-tire-inflator>]; needs to have mechanism to open and close gas flow; those that take unthreaded cartridges are cheaper)
- CO₂ cartridges (can also get these at REI [<http://www.rei.com/product/769525/genuine-innovations-16g-non-threaded-cartridge-single>]; Use 16g unthreaded cartridges; these are high pressure, so make sure to follow proper safety procedures. Cartridges cannot travel by air – not even in checked bags and can only be shipped by ground)
- Toy car, truck or any other interesting anthropogenic carbon emitter; (i.e. Cadillac Escalade) - need to be able to route a hose so it delivers CO₂ from an appropriate location (route it from the front to the back where the truck exhaust would be)
- Hose from CO₂ inflator through toy truck to flexible hose that can be put into reaction beaker. You can get this at an aquarium supply store
- Bike tire inner tube stem to thread on to CO₂ tire inflator – then hose clamp this to tubing that goes to toy truck

- Valve to reduce flow from CO₂ tire inflator to reaction vessel – the tire inflator has too much pressure to go straight into the reaction vessel (unless you just barely touch the trigger on the inflator. Note that there will be a lot of pressure on the hose between the CO₂ inflator and the pressure reducing valve. Test this thoroughly (and safely) in the shop before using the demo with kids to make sure all the tubing and fittings are strong enough.

Procedure

1. Start by adding dye to our big jug of seawater until it is a nice blue.
2. Then pour a bit of this into the reaction flask.
3. Insert the hose from toy truck (which is connected to the CO₂ tire inflator) into the reaction flask and SLOWLY squeeze the trigger on the CO₂ inflator. The inflator is under high pressure so without some sort of regulator valve or just barely squeezing the trigger or you will splash water everywhere. The water will turn yellow, demonstrating acidity. That's it.
4. Make sure to rinse the flask out a couple times with seawater before the next demo because a little residual CO₂ and dye will mess things up. This whole time you can talk about what is going on. Have one of the kids put the hose in the reaction vessel and hold it in there, but make sure you squeeze the CO₂ trigger.

Alternative Procedure

You can also do this activity with a Soda Stream (<http://www.sodastreamusa.com>) or similar carbonator. Attach the tubing to the carbonator spigot on the Soda Stream device and run it through the car and into the reaction flask. You can press the carbonator in bursts to add more CO₂ to the flask. (Make sure someone is holding the tubing in the flask as you depress the carbonator button.) The water will eventually turn yellow.



Bromothymol
Blue dye

Bike tire
inner tube stem

CO₂ cartridge

CO₂ bike tire
inflator