POPPY SCHOLARS · CHEMISTRY IN THE EARTH SYSTEM

Home lab 11 · Unit 11 · about 60 minutes

How does carbon dioxide change the pH of water, and why does a buffer resist the change?

Name _____ Date _____

MATERIALS

You supply everything. Tick each item as you gather it.

- ☐ Half a head of red cabbage (or a bag of purple cabbage), a blender or a pot, and a strainer
- ☐ Clear cups, water, a drinking straw, and a teaspoon
- ☐ Household liquids that are safe to handle: lemon juice, white vinegar, clear soda, coffee, tap water, baking soda in water, and soapy water
- ☐ Baking soda, a timer, paper and pencil

SAFETY

Never mix household cleaners such as bleach and ammonia, and do not test them: they give off toxic gases. Test only the foods and soaps listed. Blow gently through the straw and never suck in: do not drink any of the liquids, and use a fresh straw for each cup. Wash your hands afterward. Cabbage juice stains clothing.

PROCEDURE

1. Chop the cabbage and blend it with warm water, or boil it for 10 minutes, then strain. The purple juice is your indicator. It is red or pink in acid, purple near neutral, blue in weak base, and green to yellow in strong base.
2. Put 50 mL of each test liquid in its own cup. Add the same small amount of cabbage juice to each (about 2 teaspoons). Record the color and sort the liquids from most acidic to most basic.
3. Fill a cup with 100 mL of tap water, add 2 teaspoons of cabbage juice, and note the starting color.
4. Through a clean straw, blow gently into the water, one breath at a time, and count the breaths until the color changes clearly to pink or red-purple. Do 3 trials with fresh water.
5. Repeat with 100 mL of water that has 1/4 teaspoon of baking soda dissolved in it. This is a buffer. Do 3 trials, and stop at 60 breaths if there is no change.
6. Compare the means. Write the equation for CO_2 dissolving in water and the equation for bicarbonate neutralizing added acid.

RECORD YOUR DATA

Liquid	Color with cabbage juice	Acidic, neutral or basic
Lemon juice		
Vinegar		
Clear soda		
Coffee		
Tap water		
Baking soda in water		
Soapy water		

Water used	Trial 1 (breaths)	Trial 2 (breaths)	Trial 3 (breaths)	Mean
Tap water				
Baking soda water (buffer)				

LAB REPORT

Write a report that gives both tables and ranks the liquids by acidity, shows the mean number of breaths for each water sample, and uses the equations to explain why the buffered water took so many more breaths to change. Link your result to ocean acidification, and say what a pH change of 0.1 means for the hydrogen ion concentration.

Report the numbers you actually got, even when they disagree with the lesson. Write on the lines, or type your report on the website and send it to a teacher there.

Question and hypothesis *State the question in your own words, what you expect to happen, and why you expect it.*

Method *What you changed, what you measured, what you kept the same, and how many trials you ran.*

Observations *Describe what you saw, including anything unexpected. Your data tables are added to the report automatically.*

Calculations *Show each calculation step by step, with units.*

Claim and reasoning *Answer the question using your numbers, then explain why, using the science from the unit.*

Limits and next step *What could have affected your results, and one change you would make next time.*