Acids and Bases

Introduction

In our daily lives, we consume many different acids and bases in each meal, the different amounts of which affect our bodily functions. Acids and bases also influence many other living organisms. The pH level of fresh water affects the living environment in general as well. If the pH level of water is not suitable for living organisms, they could die; and a change in the environment could lead to an alteration which affects the food chain. If the food chain is affected, then numerous other vital living beings will also be affected. This can lead to a vicious cycle of the environment affecting the food chain and the food chain affecting the environment, all due to a change in the pH level. Therefore, a sufficient understanding of pH levels in the living environment is necessary.

Background

Here is a scenario which shows the importance of testing pH levels of various substances: A truck carrying waste from housing developments in upstate New York crashed off the road on its way to New Jersey. The waste spilled into streams believed to connect to the New York City reservoir, and thus New York City drinking water. The water is found to be contaminated if the pH of the water is slightly alkaline (higher pH because the waste reacts with water to make a base). You are asked to find how far the damage has extended. You have to find out the pH level of the water in streams, reservoirs, and even NYC taps in order to protect the whole metropolitan area from drinking waste water.

Similar to the living environment, living things are very sensitive to the pH level of water. The pH is a measurement scale which tells you how acidic or alkaline the solution is. For

acidic solutions, pH is scaled from 0 to 7. Acids are substances with larger percentages of H^+ ions, and have a sour taste (for example, think of lemon juice, a common acidic substance). For alkaline solution, pH is scaled from 7 to 14. Bases are substances with larger percentages of hydroxide ions (OH^-) and taste bitter and feel slippery. Both acids and bases can react with metal to produce hydrogen gas and salt. They are also able to conduct electricity in their aqueous states. A pH level of 7 is called neutral and is neither acidic nor alkaline. When acids react with bases, the chemical reaction is called neutralization (the H^+ ions cancel out with the OH^- ions). If the concentration of acids and bases are equal, the solution will become neutral and contain only water and salt. The pH of New York City tap water is different depending upon where you are and can vary even within the same building!

Objectives of this lab

1. **To determine the pH level of Pepsi, tap water, and drain remover**
2. **To understand how the pH level affects living things and their environment**
3. **To compare the ability of different materials to resist pH changes**

Equipment List

Computer
Vernier computer interface
Logger Pro Software
2 Droppers
Shampoo samples
Conditioner samples
pH Probe
Distilled water
Two 30ml Beakers
One 100 ml Graduated Cylinders
One stirring rod

Experimental Procedure

1. Measure 20 ml of tap water in a graduated cylinder and pour it into the 30 ml beaker
2. Connect the Vernier computer interface to the computer and connect the pH Probe into Channel 1 of the interface.
3. For each time you use the pH probe, you have to rinse its tip thoroughly with distilled water. When you rinse it, **DON'T** apply water directly to the tip of the pH probe because

the tip of the pH probe is very sensitive. Put it in buffer solution when you are not using it. **DON'T** let the pH probe dry out. If the probe dries out, it will be damaged and you will have to either buy another one or repair it.

4. In the Logger Pro software, a table will appears. Put the pH probe into the 30 ml beaker and collect the data by clicking Collect to measure the pH level for 1 minute.
5. When one minute is over, store the collected data by clicking "Store Latest Run" from "Experiment Menu". The data is stored in the table off to the right of where it was initially entered. Label the header of the stored data columns by double clicking on the header and typing "Tap Water" into the window that opens.
6. Rinse the pH Probe thoroughly and put it back to the buffer solution.
7. Select the data from the graph where the data is mostly constant, and then draw the best fit line by clicking to get the general equation of your data. The y-intercept is the average pH providing that the slope of the best fit line is very small.
8. Record the general equation of the graph into Table 1.
9. In a new beaker put 30ml of Pepsi. Repeat steps 4 through 8 for the Pepsi.
10. In a new beaker put 30ml of drain remover. Repeat steps 4 through 8 for the drain remover.
11. Now mix the drain remover with the Pepsi. Repeat steps 4 through 8 for the mixture.
12. After recording all the data, rinse the pH probe thoroughly and wash all the equipment using tap water. Put the pH probe back into the buffer.

Results

Name: Teacher:
Date: Teaching Assistance:

Please use the data obtained from the experiment and fill in Table 1

Table 1			
Samples	General Equation	pH	Acidity Ranking

Analysis

1. What is the reason of measuring the pH of tap water in this experiment?

2. What pH was the Pepsi? Does that mean it is an acid, base, or neutral solution? Why?

3. What pH was the drain remover? Does that mean it is an acid, base, or neutral solution? Why?

4. What pH was the mixture? Does that mean it is an acid, base, or neutral solution? What does this imply about mixing acids and bases?

5. Plot a bar graph for each sample using the data from Table 1.