Lab 5: The Ups and Downs of pH

Background:

Humans come in contact with acids and bases all the time-when cooking, cleaning and eating. Baking soda is **base** used in household cleaners. Vinegar is a weak form of acetic **acid** used in salad dressing acid. Citrus fruits contain citric acid and sodas are loaded with carbonic acid which is made when carbon dioxide combines with the water in your body. If you combine vinegar with baking soda a chemical reaction occurs with lots of fizzing and foaming that result from the interaction between the acid (vinegar) and the base (baking soda).

There are also acids in the human body. Hydrochloric acid is in your stomach and is used to digest food. The stomach acid has to be kept away from the rest of the body because it is very harsh and can cause serious damage. The lining of the stomach is especially built to survive an acidic environment.

The pH scale is used to classify substances as acids and bases. The scale goes from 0 to 14. Things that are acids have a pH number that is less than 7. The lower the number, the stronger the acid. Bases have pH values higher than 7. The higher the number, the stronger the base. An example of a strong base is drain cleaner or oven cleaner. Both strong acids and strong bases can be very harmful to your skin and tissues. Distilled water has a pH of 7, which is **neutra**l.

Water is made of 2 hydrogen atoms and 1 oxygen atom. When water breaks apart, it can form hydrogen ions (H+) or hydroxide ions (OH-). Solutions are classified as acids or bases depending upon what kinds of ions they release. Acid solutions have lots of hydrogen ions present and basic solutions have lots of hydroxide ions present. For example, stomach acid has a pH of 2 or 3, which means that it is very acidic and has lots of hydrogen ions. The pH outside of your stomach is much closer to neutral. Most of the cells in living things cannot live in the presence of a strong acid. That is why it is important that the stomach acid stays in the stomach. The cells in the stomach lining replace themselves continually because it is a rough environment in which to live.

One of the easiest ways to measure the pH of a substance is to us a **pH indicator**. pH indicators have a whole range of colors-one for every number on the pH scale. There are also pH indicators that can be found in nature. The juice produced by boiling red cabbage is useful for determining pH. A very acidic solution will turn red cabbage juice red. Neutral solutions appear purple and basic solutions turn a greenish-yellow when cabbage juice is added.

Purpose:

The purpose of this lab is to investigate the pH levels of different household substances to better understand their chemical composition and properties.

Materials:

-Phenol Red Indicator

-Household Solutions (Lemon Juice, Ammonia, Cola, Hand Sanitizer, Baking Soda, Pepto Bismol, Vinegar, Apple Juice)

-Beakers/Test Tubes with water for indicator

Procedure:

1. Copy the pH scale for Phenol Red off the board in your Data Section of the Lab Notebook.
2. Create your indicator by adding Phenol Red solution to 100 mL of water in your beaker of water, until it appears pink-red (10-15 drops should do).
3. Using eyedroppers, add drops of each solution to your indicator until you see a color change. Record the color change in the data table.

Data Table:

Table 1: pH Scale for Phenol Red

Table 2:

Solution	Color
Control (Water)	
Ammonia	
Cola	
Hand Sanitizer	
Baking Soda	
Pepto Bismol	
Vinegar	
Apple Juice	
Lemon Juice	

Results: Based on the colors you found in the data table, complete the table below.

Solution	Acid/Base/Neutral	Approx. pH
Control (Water)		
Ammonia		
Cola		
Hand Sanitizer		
Baking Soda		
Alka Seltzer		
Vinegar		
Apple Juice		
Lemon Juice		

Discussion Questions: *Use complete sentences to answer each of the following*:

1. How does a difference in 1 pH unit change in terms of H+ concentration? Ex: How does a solution with a pH of 3 differ from a pH of 4? Which is stronger? Which is weaker? Why?

2. Whenever you mix an acid with a base, they neutralize each other. If this is the case, why is Alka- Seltzer used to treat stomach aches? (Note: excess stomach acids cause stomach aches)

3. What is acid rain, and how is it a problem to lakes, oceans, streams, etc.?