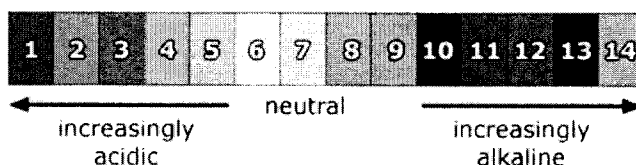


Red Cabbage Lab: Acids and Bases

Introduction:

Liquids all around us have either acidic or basic (alkaline) properties. For example, acids taste sour; while, bases taste bitter and feel slippery. However, both strong acids and strong bases can be very dangerous and burn your skin, so it is important to be very careful when using such chemicals. In order to measure how acidic or basic a liquid is, one must use the pH scale as illustrated below:



The strength of the pH scale is determined by the concentration of hydrogen ions (H^+) where a high concentration of H^+ ions indicate a low pH and a high concentration of H^+ ions indicate a high pH. The pH scale ranges from 1 to 14 where 1 to 6 is classified as acidic, 7 neutral (neither a base or an acid) and 8 to 14 is classified as basic.

In this lab, you will use the juice from red cabbage as a pH indicator to test common household liquids and determine their pH levels. You will mix cabbage juice with different household liquids and see a color change produced by a pigment called flavin (an anthocyanin) in red cabbage. Through this color change, you will be able to successfully identify the approximate pH of common household liquids using the table below:

Color:	Pink	Dark Red	Violet	Blue	Blue-Green	Green-Yellow
Approx. pH	1-2	3-4	5-7	8	9-10	11-12
Acid/Base	Acid	Acid	Acid/Neutral	Base	Base	Base

Strength increases at extremes of this scale.

Materials:

Pre-Cut Cabbage
Blender
Strainer
Large Container
~1L Beaker
7 plastic cups
7 plastic spoons

Liquids to Test:

- Lemon Soda
- White Vinegar
- Apple Juice
- Baking Soda
- Shampoo (preferably clear)
- Conditioner (preferably clear)
- Hand Sanitizer

Pre-Laboratory Predictions:

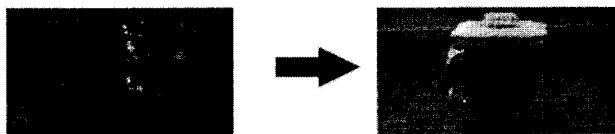
Look at each of the liquids being tested. Predict whether each of the substances is acidic, neutral or basic. Circle one. (Think about the properties of acids and bases.)

Hand Sanitizer	Acidic	Neutral	Basic
Lemon Soda	Acidic	Neutral	Basic
Apple Juice	Acidic	Neutral	Basic
White Vinegar	Acidic	Neutral	Basic
Baking Soda	Acidic	Neutral	Basic
Shampoo	Acidic	Neutral	Basic
Conditioner	Acidic	Neutral	Basic

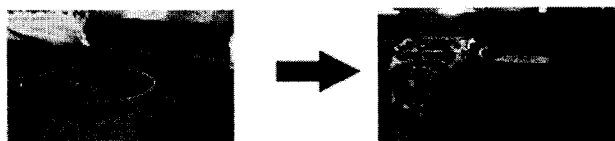
Instructions:

Preparing the Cabbage Juice:

1. Put the red cabbage leaves into the blender with 800mL of water.
2. Close the top and let it blend at high power for 30 seconds.



3. Once it is blended, filter out the leaves inside the mixture with the strainer and pour the mixture into a large container.



*This should provide you with 600-800 ml of cabbage juice.

Mixing the Cabbage Juice:

4. Label each cup with each of the liquids. (Example: vinegar, apple juice, etc.)
5. Pour 100 ml of each individual liquid into its respective cup (except for baking soda).

6. For baking soda, add 3 tablespoons of baking soda into 100 ml water.

Example:



7. Pour 50 ml of cabbage juice into each of the cups. Do this one at a time and record the color change below:

Liquid:	Color Change/ pH	Actual pH
Hand Sanitizer		
Lemon Soda		
Apple Juice		
White Vinegar		
Baking Soda		
Shampoo		
Conditioner		

Now look up the actual pH of each of the substances and see how accurate the cabbage juice indicator was!

How did your reasoning for your predictions change after seeing the approximate pH level?

8. Categorize your results below:

Strong Acids	Weak Acids	Neutral	Weak Bases	Strong Bases

Now add 10 tablespoons **more** of baking soda into a new cup.

*Does the color intensity of the liquid change?
If so, how and why do you think this is?*

Concept Questions:

1. Does the addition of water (baking soda + water) alter the pH of weak acids/bases? How does it change the pH of strong acids/bases? Why or why not?
2. How does a difference in 1 pH unit change in terms of H^+ concentration? Example: How does a pH of 3 differ from pH of 4? Which one is stronger or weaker? Why?
3. Look at the ingredients for each liquid you tested. Which ingredients contribute to each of the liquid's pH level?

Real Life Applications:

1. Neutralization: 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)
2. Acid Rain: What is acid rain and how is it a problem to oceans, rivers, lakes, ponds ect.?

References: