Jonathan Quang 9/20/14

1WW

Lab #3 Write Up

Question: Which solution is most resistant to change in pH when acids and bases are added to it?

Hypothesis: If a base or acid is added to a solution, then the buffer would be the least resistant to change because a buffer is made to be resistant to change in pH.

Materials:

• Computer with attached pH sensor   
• A test tube rack with two tubes-label one 0.1N HCl, label the other BASE   
• Micropipette – 100 μl or one that is set at 100 μl plus tips as needed  
 • 50 ml beakers for solutions   
• 250 ml beaker for rinsing sensor tip   
• 0.1N HCl solution   
 • 0.1 N NaOH solution   
• Squeeze bottle of deionized water (“rinse bottle”)   
• Various biological materials such as apple juice, cranberry juice, potato extract, etc.  
 • Buffer solutions of pH 4, pH 7, and pH 10

Procedure:  
1. Turn on computer and open Logger Pro or Logger Lite.  
2. Connect the sensor to the computer via the USB port.  
3. Fill one of the small beakers with 20 ml of water.  
4. Using the electrode tip, take the pH of the water.  
5.Wait a few seconds for the pH to stabilize and record the pH.  
6. Using the micropipette, add 100 μl of 0.1N HCl to the water. Mix the HCL and water by swirling the beaker gently.  
7. Wait until the pH stabilizes. Record the pH measurement.  
8. Repeat steps 2 through 7 nine more times for a total of 1000 μl of 0.1N HCl added to the water.   
9. Throw out the water and rinse the beaker and electrode tip.  
10.Repeat steps 2 through 9 using the provided base instead of the acid.  
11.Each group will select a buffer.  
12. Pour 20 ml of buffer into a small beaker. Repeat steps 4 through 9 using 0.1N HCl  
13. Pour 20 ml of a buffer into a clean beaker and repeat steps 4 through 9 using the base and the buffer.  
14. Record group data in the class table if possible.  
15.Each group will select a biological liquid.  
16. Pour 20 ml of liquid into a small beaker. Repeat the steps 4 through 9 using 0.1N HCl  
17. Pour 20 ml of liquid into a small (cleaned) beaker and repeat steps 4 through 9 using the provided base.  
18. Record group data in the class table if possible.

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Biology - Ms.Prabhu

Data:

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 0(Initial)ul | 100ul | 200ul | 300ul | 400ul | 500ul | 600ul | 700ul | 800ul | 900ul | 1000ul |
| HCL and H20 | 8.11 | 4.2 | 3.9 | 3.63 | 3.62 | 3.48 | 3.42 | 3.35 | 3.28 | 3.2 | 3.16 |
| NaOH and H2O | 6 | 8.52 | 10 | 11 | 11.55 | 11.67 | 1.79 | 11.98 | 12.02 | 12.08 | 12.12 |
| HCL and Buffer with a pH of 4 | 4.94 | 4.8 | 4.68 | 4.57 | 4.46 | 4.35 | 4.25 | 4.21 | 4.15 | 4.08 | 4.02 |
| NaOH and Buffer with a pH of 4 | 4.94 | 5 | 4.89 | 4.93 | 4.98 | 5.03 | 5.09 | 5.15 | 5.21 | 5.27 | 5.3 |
| HCL and Biological Substance | 3.96 | 3.89 | 3.85 | 3.83 | 3.81 | 3.79 | 3.77 | 3.75 | 3.74 | 3.72 | 3.71 |
| NaOH and Biological Substance | 3.95 | 3.92 | 3.92 | 3.97 | 3.97 | 3.97 | 3.99 | 4.01 | 4.03 | 4.05 | 4.07 |

Answers:  
1. The independent variable is the amount of HCL or NaOH added to the substance.  
2.The dependent variable is the pH of the substance.  
3.Adding acid to each substance decreases the overall pH of the substance.  
4. Acid does have a noticeable difference between the solutions it was tested on. The pH of water dropped a lot after the first 100ul was added, from 8.11 to 3.6. The buffer and the biological substance only dropped by a pH of 0.92 and 0.25 respectively.  
5.Adding a base to each substance increased the overall pH.  
6.Adding the base to each substance had a noticeable difference because the pH of water increased the most, the buffer increased the second most, and the pH of the biological substance increased the least. The pH of water increased by over 6, while the pH of the buffer and biological substance increased by 0.36 and 0.11 respectively.  
7.It was of value to include the plot of water with a base and acid added to it because it functioned as a control for the other substances. Water, by itself, exhibits no form of pH control, which makes it an excellent choice for a control.  
8. The material that made the best buffer would be the fruit juice. Its initial pH changed the least. It only changed a total of 0.25 and 0.11 when an acid and a base were added to it respectively. Water and the buffer changed the most, as evidenced by the differences calculated above.  
9. Water is the poorest buffer because its pH changed the most. In the differences calculated above, water is the only one that changed by over 1pH.