**pH Indicator Lab MAKE-UP**

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Pre-Lab:** In this lab, use several pH indicators to determine the pH levels of various solutions. Predict which solutions are acidic, basic, or neutral.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Acid | Neutral | Base |
| HCl |  |  |  |
| NaOH |  |  |  |
| NH4OH |  |  |  |
| H3PO4 |  |  |  |
| Rubbing Alcohol  |  |  |  |
| Apple Juice  |  |  |  |
| Tap Water |  |  |  |
| Drain Cleaner |  |  |  |

**Warning!** You are using some strong acids and bases. Clean up spills and rinse off any areas of contact with skin ***immediately***. Also, the indicators will stain clothing if spilled. Please be careful.

**Instructions:**

1. Put on goggles and an apron.

2. Get a well plate, making sure it is clean. If it is not, rinse it out with distilled water.

3. For each solution in the chart above, add 6 drops of the test solutions to three different wells in the plate. Pay attention to what test solution is in each row of wells. (You will need three wells of each test solution.) *Please leave droppers with the solutions.*

4. Use a dropper to put 1 drop of litmus solution in the 1st well of test solution. Record the color of the mixture (indicator and solution) in the chart below.

5. Use the litmus color chart below to estimate the pH of the test solution.

6. Next, add 1 drop of the red cabbage indicator to the 2nd well of test solution. Record the color.

7. Use the red cabbage color chart to estimate the pH of the solution.

8. Then, add 1 drop of the universal indicator to the 3rd well of test solution well. Record the color.

9. Use the universal indicator color chart to estimate the pH of the solution.

10. Repeat these steps for all of your test solutions.

11. When finished, clean up your lab station and wash your hands. You must keep your goggles on until all groups are finished.

12. Based on your results, categorize your results on the following chart as a: Strong Acid (SA), Weak Acid (WA), Neutral (N), Weak Base (WB), or Strong Base (SB).

**Litmus Indicator**:

|  |  |  |  |
| --- | --- | --- | --- |
| Color: | Red | Purple | Blue |
| Acid/Base | Acid | Neutral | Base |

**Red Cabbage Indicator**:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 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 | Strong Acid | Acid | Acid/Neutral | Base | Base | Strong Base |

**Universal Indicator**:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Color: | Red | Orange | Yellow/Green | Green | Blue/Green | Blue | Purple |
| Approx. pH | 1-2 | 3-4 | 5-6 | 7 | 8-9 | 10-11 | 12-13 |
| Acid/Base | Strong Acid | Acid | Acid | Neutral | Base | Base | Strong Base |
|  | Color from Litmus | Litmus Estimated pH | Color Red Cabbage | Cabbage Estimated pH | ColorUniversal Indicator | Universal Indicator pH | SA, WA, N, WB, or SB |
| HCl | Red |  | Pink |  | Red |  |  |
| NaOH | Blue |  | Yellow |  | Blue |  |  |
| NH4OH | Blue |  | Green |  | Purple |  |  |
| H3PO4 | Red |  | Pink |  | Red |  |  |
| Rubbing Alcohol  | Purple |  | Violet |  | Yellow |  |  |
| Apple Juice  | Red |  | Pink |  | Orange |  |  |
| Tap Water | Purple |  | Blue/green |  | Purple |  |  |
| Drain Cleaner | blue |  | yellow |  | Purple |  |  |

**Conclusion Questions:**

1. a.) How would the addition of water (test solution + H2O) alter the pH of weak acids/bases? Explain.

 b.) How would adding water change the pH of strong acids/bases? Explain.

 d.) How would the pH be changed by doubling the concentration of the solute of a strong acid/base?

2. a.) How does increasing pH by 1 unit change in terms of [H+] concentration? (Ex.: pH=3 vs pH=4?)

 b.) Does a higher pH indicate is stronger or weaker [H+] concentration?

c.) Prove your answer by finding the [H+] concentration for a solution of pH=3 and then for a solution with pH=4. Circle the larger answer.

3. Look at the ingredients for the drain cleaner. Which ingredient(s) contribute to the pH level?

4. When a strong acid is spilled – on the highway during a traffic collision, or in the laboratory – the acid is diluted with water and then neutralized with a weak base such as baking soda (NaHCO3). Even though a strong base such as NaOH would neutralize the spill faster, a weak base is used. Why?

5. What is acid rain and how is it a problem to oceans, rivers, lakes, ponds, etc.?

6. What is the pH range of most foods? Why?