Name_____

Acid-Base Lab

We will use several different indicators to determine the acidity or alkalinity of several compounds. Indicators are things that change color at different pH levels. Of course error can arise with your ability to determine what color they turn. Some indicators will turn colors not indicated like litmus which turns either red or blue can turn purple (which is a mixture of red and blue). This means you have to estimate the pH is right around the point where it changes is.

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Several indicators will also be used in this lab to test pH.

Litmus turns red in an acidic solution (pH 0-7) and blue in an basic solution (pH 7-14).
Phenophthalein is clear with a pH 0-8, and red 8-14.
Bromthymol Blue is yellow with a pH of 0-6, green between 6-7 and blue 8-14.
Thymol Blue is red with a pH 0-3, yellow from 3-8, and blue 8-14.
Alazarin Yellow is yellow 0-10, orange from 10-11, pink for 11-12 and red from 12-14.
Methyl Orange is red 0-3.1 orange to yellow orange from 3.1-14.
Indigo Carmine is blue 0-11.6 shades of green from 11.6-13 and yellow from 13-14 .
Methyl Red is red from 0-5 and yellow from 5-14.
Methyl Violet is yellow for 0-.5, light blue for 0.5-1.5, and violet 1.5-14
There is also a color chart of all of these indicators except indigo carmine in your notes.

Procedure:

1. Add about 10 drops of each of the following to 6 individual wells in one row of your microplate. HCl, NH_4OH, CH_3COOH, NaOH, $NaHCO_3$, and H_2O

2. Place one or two drops of litmus solution into each well, observe the color and record it in the table on the next page. In the table on the line with Litmus on it write the color you observe in the top square. For litmus there are actually 3 color possibilities red, blue and purple (the shade of the color is dependent on the how much indicator you added). If it is red, using the chart above, the range is 0-7. If the color is blue, the range is 7-14. If it is purple, a mix of blue and red, then the solution is close to that transition point. You have to estimate, I would say about 5-9.

3. Repeat step 1 in six different wells, Place one or two drops of phenolphthalein into each well with the different solutions record your observations and the possible pH of the solutions (use the chart above).

4. Repeat this process with bromthymol blue, thymol blue, alazarin yellow, methyl orange, indigo carmine, methyl red, and methyl violet.

5. In the last row of the chart, compare all possible pH ranges found and determine the lowest possible pH range of the solution. If you found it had a pH range of 7-14 on the first test and a pH range 0-8 on the second test. The solution must be from 7-8 (it is the only range that fits into both).

6. If your final pH range of solution is greater than 3, then it is wrong. So 0-3 is good, that is a range of 3, 6-8 is good, that is a range of 2. 7-14 is wrong, that is a range of 7. 0-14 is wrong, that is a range of 14. You may find errors in this step (if you found it was between 0-5 with one indicator and 8-14 with another). In this case you can recheck if still have the chemicals or use your better judgment to determine which is incorrect.

	HCl	NH_4OH	CH_3COOH	NaOH	$NaHCO_3$	H_2O
Litmus Color						
Range						
Phenolphthalien Color						
Range						
Bromthymol blue Color						
Range						
Thymol Blue Color						
Range						
Alazarin yellow Color						
Range						
Methyl red Color						
Range						
Methyl orange Color						
Range						
Methyl violet Color						
Range						
Indigo Carmine Color						
Range						
What is the pH range of the soln.						

1. Fully explain how an acid/base indicator works including equilibrium.

2. Fully explain how a buffer works including equilibrium.

3. Determine the pH, pOH and $[OH^-]$ of a solution with a $[H_3O^+]$ of 1.34×10^{-6} M?

   pH =

   pOH=

   $[OH^-]$ =

4. What is the pH, $[OH^-]$ and $[H_3O^+]$ of a solution with a pOH of 5.42?

   pH =

   $[H_3O^+]$ =

   $[OH^-]$ =

5. Determine the pH, pOH and $[H_3O^+]$ of a solution with a $[OH^-]$ of 3.31×10^{-4} M?

   pH =

   pOH=

   $[H_3O^+]$ =

6. What is the pOH, $[OH^-]$ and $[H_3O^+]$ of a solution with a pH of 2.42?

   pOH=

   $[H_3O^+]$ =

   $[OH^-]$ =

7. Label the acid, base, conjugate acid, conjugate base.

   $ClO^- + H_2O \leftrightarrows OH^- + HClO$

   $H_3PO_4 + H_2O \leftrightarrows H_3O^+ + H_2PO_4^-$