

Chem 159 – The Chemistry of Everyday Things Lab

Experiment 3 – Preparation and Use of a Chemical Indicator and pH Meter

Part I: pH Tests

1. Put on your goggles!
2. Fill up your plastic wash bottle with distilled water (if necessary).
3. Turn on the pH meter. Rinse the electrode with distilled water. Dip the electrode into the first buffer solution (pH 4). Adjust the meter so it reads exactly pH 4.
4. Rinse the electrode in distilled water between each test. Wipe dry with a tissue.
5. Calibrate the meter using the second buffer (pH 10). **NOTE:** *if you were testing only acids you would calibrate your meter between a pH 4 and 7. If you were testing only bases you would calibrate in the higher pH range (basic). Since we are testing **both** acids and bases, we are calibrating a much wider range of pH readings.)*
6. Break the leaf of a raw purple cabbage into pieces. Press them against the bottom of a 400ml or 600ml beaker. Add enough water to just cover the pieces of the cabbage.
7. Using a ring stand set-up, boil the cabbage leaves until the solution is a deep purple color. Cool and store the liquid. Throw away the cabbage fragments.
8. Prepare a data table like the one shown on p. E25. Conduct the pH tests.
 - A. **Universal indicator test:** set up one test tube for each sample to be tested. Test a small volume of each liquid and record your observations. Do not forget to dilute the samples marked with an (X) on p. E24! For the solids, dissolve a small amount in your test tube with water; then test pH. Do not discard the test tubes, since you will use them for the next tests!
 - B. **Cabbage juice test:** Using the same tubes from test A, add enough of the cabbage juice using a pipet to give a permanent color change. Shake well to give a consistent color. Note the color change. Green indicates a base, red indicates an acid, and no change (purple) indicates neutral.
 - C. **pH meter test:** Pour the solution from your first test tube into a clean 50ml beaker. Add enough distilled water to it to make about 15ml of solution. Test using the pH meter. Be sure to rinse the electrode with distilled water and wipe dry with a tissue between each test. Repeat for all your samples. Record your findings.

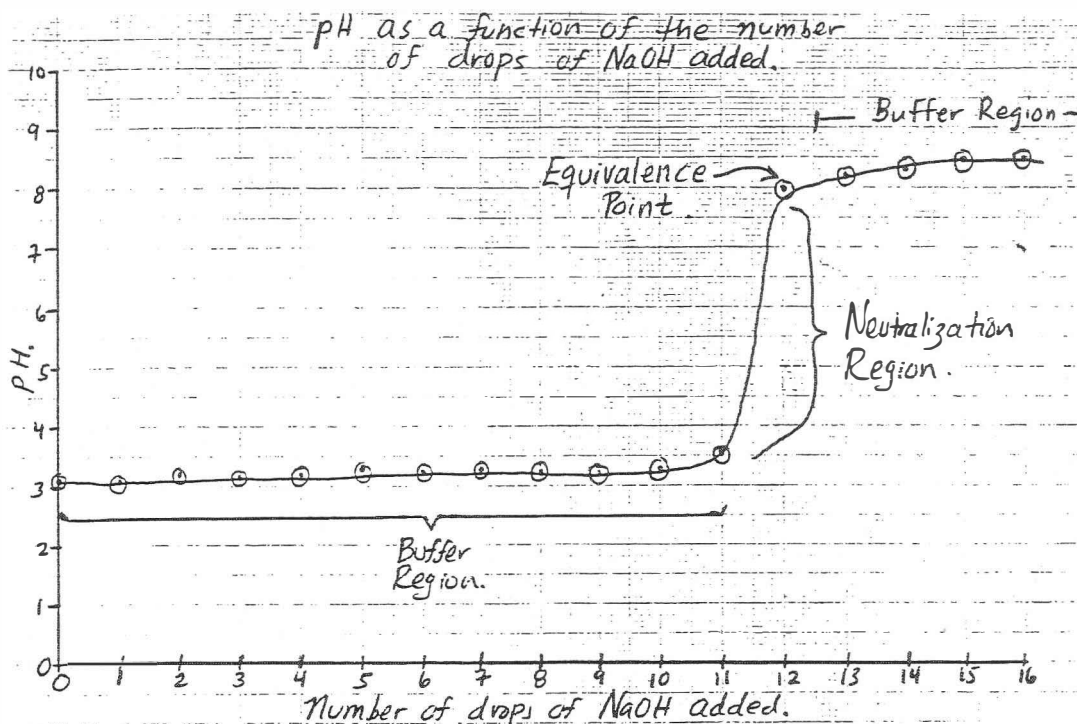
Part II: Titration

A titration is a technique that measures the amount of a particular substance present in a solution. In this case, we will neutralize an acid, HCl, by using a base, NaOH.

1. Add 10 drops of 0.1M HCl to 50ml of distilled water, and then mix well. (Use a 150ml beaker)
2. Add 3 drops of the indicator phenolphthalein, which is a chemical that will indicate when the solution has reached a pH of 8.3 via a color change.
3. Determine the pH using the meter. pH = _____
4. Add 0.1M NaOH, one drop at a time, using your buret while stirring (with the electrode) until the solution turns pink. Determine the pH and the color after each drop. A sample data table may look like this:

No. of drops of NaOH added	pH	Color
1	3.1	Colorless
2	3.1	Colorless

5. Once the solution **stays** pink, add one drop of HCl. What happens to the color?
_____. What is the pH now? _____
6. Continue the titration with NaOH (a few more drops) until the pH starts to level off again.
7. Graph the pH as a function of the number of drops of NaOH added. A sample graph may be:



8. Label the equivalence point, neutralization region, and buffer regions of your graph.
9. Calculate the $[H^+]$ of vinegar _____, ammonia _____, distilled water _____, and boiled distilled water _____. To do this, use the following formula $[H^+] = 10^{-pH}$
10. Clean up your station before leaving.

EXPERIMENT III

Preparation and Use of Chemical Indicator and pH Meter

Record your **observations** in a table similar to the one shown below. Be generous with space. It may take up two pages in your lab book.

Substance	Universal Color of pH paper	Indicator pH number (from pH paper)	Cabbage Juice Indicator Color	pH Meter reading	Comment
Vinegar	pink	3-4	Medium red	5.2	Weak acid
Baking Soda	Green-blue	8-9	Teal, blue	9.6	Weak base

Samples for pH determination*

<i>LIQUIDS</i>	<i>SOLIDS</i>
Vinegar	Borax
Household Ammonia	Baking soda
Soft drinks (lemon lime and Cola)	Laundry detergent
Lemon Juice (X)	Salt
Laundry Bleach (X)	Boric acid
Dishwashing Liquid (X)	
Hair Shampoo (X)	
Distilled (Deionized) water	
Boiled distilled water	
Tap water	

* Dissolve 1ml of the liquids marked (X) in about 5ml H₂O before measuring the pH.

In the case of the solids, take a tipful using your micro spatula and dissolve in about 5ml of H₂O.