

Acid and Base pH Lab

Introduction

In this lab, you will be determining the pH of various liquids using three methods – liquid indicators, pH paper and direct measurement.

The first method, liquid indicators, is still widely used to determine the approximate pH of a liquid. The disadvantages of using liquid indicators is that it is difficult to determine an exact pH value. It also cannot be used very well with liquids that are not colorless to begin with.

The second method, using pH Universal Indicator paper, is useful for determining the pH of a liquid to the nearest whole number. If you are measuring a liquid that is not clear, it is still possible to determine the pH by looking at the dry/wet contact.

The third method involves using an electronic probe to measure pH. You would think that this method would yield the most accurate results, but probes do have problems staying calibrated, and may give false readings from time to time.

You will use all three methods to determine the name of five liquid samples using pH alone. When you are done with the first procedure (using the liquid indicators), make sure the instructor signs off on your research.

Procedure

1. Obtain and wear safety glasses. You will be using a number of hazardous chemicals in this lab. Keep your safety goggles on at all times. If any substance comes in contact with your skin, immediately rinse with water and alert the instructor.
2. Using your test tube rack, obtain nine CLEAN and DRY test tubes and place them in your rack.
3. Using a pipette, place into your nine test tubes approx. 3 mL of a single sample (place the same liquid in each of the nine test tubes). Make sure to record the sample number!
4. In each of 8 of the test tubes, carefully add two drops of each of the eight indicators. Liquid indicators turn a certain color depending on the pH. The color change is gradual with some indicators and dramatic with others. Some indicators may react with the solution and give totally bogus results, so be careful! There are others still that change color twice depending on the pH. Use the table below to determine the pH color for each indicator.

Indicator	pH Range (color) to	pH Range (color)
Brilliant Green	0.0 (yellow) – 2.6+ (green)	
Thymol Blue	1.2 (red) – 2.8 (yellow)	8.0 (yellow) – 9.2 (blue)
Cresol Red	2.0 (orange) – 3.0 (amber)	7.2 (yellow) – 8.8 (red)
Congo Red	3.0 (blue) – 5.0 (red)	
Bromcresol Purple	5.2 (yellow) – 6.8 (purple)	
Bromthymol Blue	6.0 (yellow) – 7.6 (blue)	
Thymolphthalein	8.8 (clear) – 10.5 (blue)	
Clayton Yellow	11.0 (yellow) – 13.0 (red)	

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5. Record your observations or conclusions for each test. In each box, you should either write the color of the indicator, and the pH range for the indicator (for example, if Brilliant Green turns green, you would write in the box **Green >2.6** (meaning the pH of the substance you are testing is greater than 2.6). When you have finished with all 8 indicators, determine the pH range of the sample in the boxes provided. Have the instructor sign-off on this section when you are done.
6. Using Universal Indicator paper, determine the pH of the substances. Obtain a glass rod, and insert the glass rod (make sure it is clean and dry) into the remaining untested test tube and then dab the glass rod onto a piece of Universal Indicator paper. Compare the color to the chart and record your estimate of the pH in the boxes below.
7. Next, determine the pH using a pH probe. If you are using a LabPro system, set-up your pH probe using your calculator (see the instructor if you need help with this). Choose the **Monitor Input** option so that the pH is constantly displayed and updated. Once you have set-up the probe, carefully unscrew the probe from the plastic holder bottle and insert the probe into the same test tube as in step #6. Let the probe remain in the solution for at least 30 seconds before taking a reading. Record your answer below. If you are using a dedicated pH probe, place the probe in the liquid and wait for the reading to stabilize. Record your answer.
8. **IMPORTANT NOTE ABOUT DUMPING CHEMICALS!!! Sample #1 and Sample #3 get dumped in the large beakers in the hood (MAKE SURE YOU DUMP IT IN THE CORRECT BEAKER!!!).** The other materials can be dumped down the drain of your small sink (make sure to run the water for at least 15 seconds before you start dumping and when you are finished). Rinse thoroughly and dry all glassware used in this experiment. Return the pH probe into the holder bottle.
9. Repeat steps 2-7 for all five solutions.
- 10 Use the pH of common substances table to determine the name for each of five substances.
11. Clean-up when you are done.

DATA TABLE

Indicator/Sample Number	#1	#2	#3	#4	#5
Brilliant Green					
Thymol Blue					
Cresol Red					
Congo Red					
Bromcresol Purple					
Bromthymol Blue					
Thymolphthalein					
Clayton Yellow					
pH Range of Sample					
pH of sample using Universal Indicator Paper					
pH of sample using pH Probe					
Name of Sample					

pH of Common Substances Table

pH	Substance	
14.0	Lye	Base
12.6	Sodium Hydroxide	
12.4	Lime (Calcium hydroxide)	
11.0	Ammonia (NH ₃)	
10.5	Magnesium Hydroxide (Antacids)	
8.3	Sodium Bicarbonate (Baking Soda)	
7.4	Human Blood	
7.0	Pure Water	
6.6	Milk	Acid
4.5	Tomatoes	
4.0	Alcohol	
3.0	Apples	
2.2	Acetic Acid (Vinegar)	
2.0	Citric Acid	
1.0	Sulfuric Acid	
0	Hydrochloric Acid	