

pH of Households

PA State Standards:

- 3.4.12.A Apply concepts about the structure and properties of matter.
1.2.11.A Read and understand the central content of informational texts and documents in all academic areas.

Introduction:

The pH scale goes from 0 – 14. Acids have a pH below 7, bases have a pH above 7, and neutral substances have a pH around 7. The further from 7, the stronger the acid or the base.

This lab investigates the pH of household substances; there are three variations. In the first, litmus paper is used to determine if the substance is an acid or a base. Red litmus paper turns blue in a base; blue litmus paper turns red in an acid. In the second method, the 39 drop scale is used. For this method, drops of two solutions are mixed together in different proportions so that the total number of drops equals 39. Each of these mixtures is a solution of a different pH. Universal Indicator is added to each mixture to make a reference for the household substances, which will also be tested with Universal Indicator. In the third method, a pH meter is used to determine a numerical value for the pH of the substance.

Equipment/Materials:

Wellplates	DI water
Droppers	Drain Cleaner
Universal Indicator	Peroxide
Litmus Paper – Red and Blue	Colorless soda
Solution A	Rubbing Alcohol
Solution B	Vinegar
Ammonia	pH meter
Aspirin (aq)	Wash bottle of DI water
Baking powder (aq)	Buffer
Baking soda (aq)	Kimwipes

Safety:

- Wear safety glasses.
- Avoid contact of the solutions with skin and clothing.

Guiding Question:

Predict the pH for the following household chemicals based on your familiarity with each. Guess their pH and predict whether they will be strong acids, weak acids, neutral, weak bases, or strong bases.

Sample	pH	Strong Acid, Weak Acid, Neutral, Weak Base, Strong Base
Ammonia		
Aspirin (aq)		
Baking powder		
Baking soda		
Drain cleaner		
Peroxide		
Rubbing alcohol		
Soda		
Vinegar		
Water		

Procedure:**Method 1: Litmus Paper**

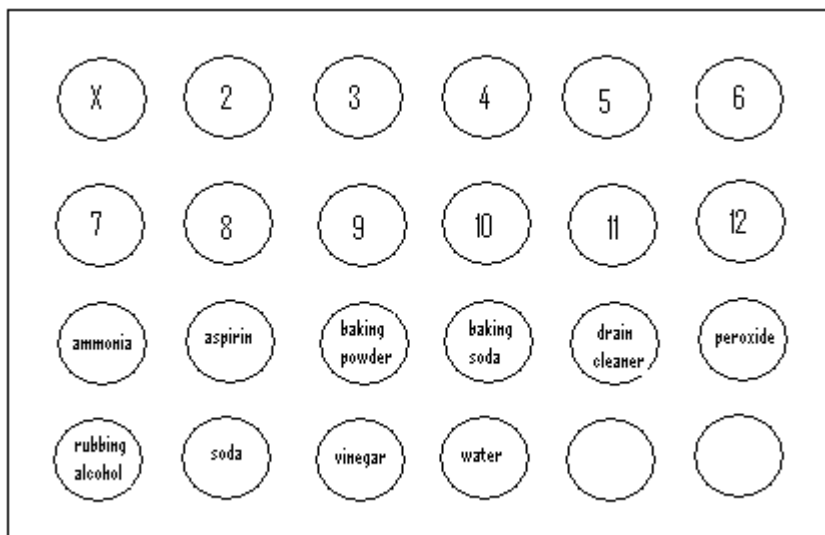
1. Place a paper towel on the lab bench.
2. Obtain 5 pieces of red litmus paper and 5 pieces of blue litmus paper. Tear each piece in half and lay them out on the paper towel so that there is a row of 10 pieces of red litmus paper and a row of 10 pieces of blue litmus paper.
3. Using a dropper or a stirring rod, apply a small amount of a sample to a piece of red litmus paper and a piece of blue litmus paper. **If using a dropper, do NOT squeeze drops of sample onto the paper. Just touch the dropper to the paper.** If the paper towel is getting wet, you are using too much sample.
4. In the data section for Method 1, record the color of each paper.
5. Repeat for all samples.

Method 2: 39 Drops

- Using the chart and diagram below, mix the appropriate number of drops of solutions A and B in 11 different wells in the wellplate. Each different mixture will be a different pH.

Note: Be careful not to contaminate the droppers by using them in more than one solution or by touching them to a well!

PH units (+/- 0.1 pH units)	# Drops of Solution A	# Drops of Solution B
2	39	0
3	35	4
4	31	8
5	27	12
6	24	15
7	20	19
8	17	22
9	14	25
10	11	28
11	9	30
12	3	36



- Using droppers, place a similar amount of each household chemical into an empty well of the wellplate. Follow the diagram above.
- Place 2 drops of Universal Indicator in each of the reference wells and in each of the sample wells.
- Compare the sample wells with the reference wells, and record the appropriate pH for all of the samples on the data table.

Method 3: pH Meter

1. Place a sample in a well so that the well is 1/2 to 2/3 full. Be sure to diagram the location of the sample. (The diagram in method 2 may be used.)
2. Repeat for each of the samples.
3. Standardize the pH meter according to the instructions that pull out from the center of the meter. The instructor may take you through this as a class.
4. Rinse the electrode with DI water and blot carefully with a Kimwipe. Insert the electrode into one of the samples. When the reading stabilizes, record the pH in the data table.
5. Repeat for all samples, being sure to rinse the electrode thoroughly and blot dry between samples.
6. When finished with the meter, rinse it again. Place a SMALL amount of DI water in the cap and place it over the electrode.

Data:**Method 1: Litmus Paper**

Sample	Red Litmus	Blue Litmus	Acid/Base/Neutral
Ammonia			
Aspirin (aq)			
Baking powder (aq)			
Baking soda (aq)			
De-ionized Water			
Drain cleaner			
Peroxide			
Rubbing alcohol			
Soda			
Vinegar			

Data:**Method 2: 39 Drops**

Sample	pH	Strong Acid, Weak Acid, Neutral, Weak Base, Strong Base
Ammonia		
Aspirin (aq)		
Baking powder (aq)		
Baking soda (aq)		
De-ionized Water		
Drain cleaner		
Peroxide		
Rubbing alcohol		
Soda		
Vinegar		

Data:**Method 3: pH Meter**

Sample	pH	Strong Acid, Weak Acid, Neutral, Weak Base, Strong Base
Ammonia		
Aspirin (aq)		
Baking powder (aq)		
Baking soda (aq)		
De-ionized Water		
Drain cleaner		
Peroxide		
Rubbing alcohol		
Soda		
Vinegar		

Questions:

1. Which of the tested compounds should be handled with care in the home? Why?
2. Compare your data to your predictions. Which household chemicals gave unexpected results?
3. Are your results among the three methods consistent? Discuss any samples that did not give the same results with each method.
4. If you were going to conduct a study of a stream, which of the above methods would you use to determine pH in the stream, and why?