

Wednesday  
April  
22  
2020

**AIM**

- What is pH?

**AGENDA**

- pH notes/activity
- U10L6 video

**YOYO**

- Pull up the U10L6 (unit 10 lesson 6) video on YouTube

**HOMEWORK**

- Nothing due tonight
- Follow the calendar

1

## Effects of Acid Rain

- The Taj Mahal
  - Made of marble (calcium carbonate)
  - When marble comes in contact with acid, the structure became damaged

2

## Effects of Acid Rain

- The Statue of Liberty – Why is it green?
  - Originally made of copper (the color of a shiny penny)
  - Chemical weathering occurs with the copper reacts with the acid rain
  - The chemicals in acid rain react to form copper oxide (what produces the famous green color) due to a process called oxidation

3

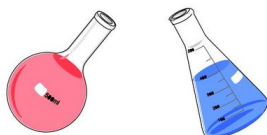
## The pH Scale

4

## Acidic, Basic, and Neutral Solutions

- Acid Solutions: (acid in water)
  - $[H_3O^+]$  or  $[H^+] > [OH^-]$
- Basic Solutions: (base on water)
  - $[H_3O^+]$  or  $[H^+] < [OH^-]$
- Neutral Solutions: (just water)
  - $[H_3O^+]$  or  $[H^+] = [OH^-]$

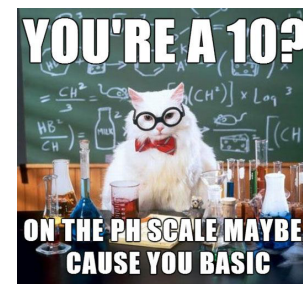
### ACIDS AND BASES



5

## pH: The Power of Hydronium $[H_3O^+]$

- The pH scale is used to measure the **hydrogen ion concentration  $[H^+]$**
- **$pH = -\log[H^+]$**
- Acidic solutions:  **$pH < 7$**
- Neutral solutions:  **$pH = 7$**
- Basic solutions:  **$pH > 7$**



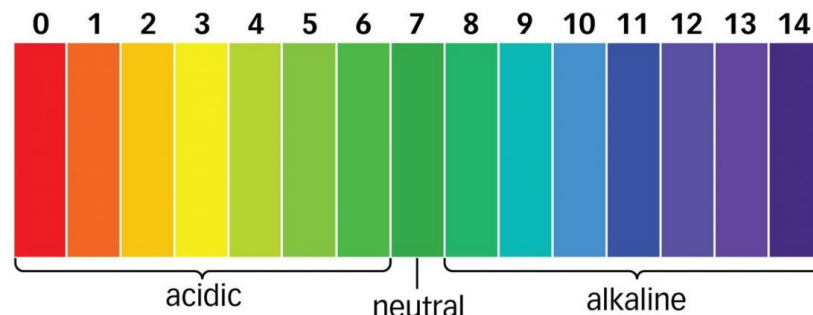
6

## Measuring pH

- If  $[H^+] = 1.0 \times 10^{-4}$ , the pH is 4
- The exponent gives you the pH
- At pH 4,  $[H^+] = 1 \times 10^{-4} M = 0.0001 M$
- A solution with a pH of 3,  $[H^+] = 1 \times 10^{-3} M = 0.001 M$
- When the pH decrease by **1 unit**, the concentration of hydrogen ions increase by a factor of **10 (10 times greater)**

7

## The pH Scale



8

## The pH Scale



- Measures how acidic or basic a substance is
- Ranges from from **0 – 14**
- **pH = 7:**
  - **Neutral** –  $[\text{H}_3\text{O}^+] \text{ or } [\text{H}^+] = [\text{OH}^-]$
- **pH < 7: (Below 7)**
  - **Acidic** –  $[\text{H}_3\text{O}^+] \text{ or } [\text{H}^+] > [\text{OH}^-]$
- **pH > 7: (Above 7)**
  - **Basic** –  $[\text{H}_3\text{O}^+] \text{ or } [\text{H}^+] < [\text{OH}^-]$
  - Basic = **alkaline**

9

## The pH Scale



- The pH system is **logarithmic**, so...
  - Each whole pH value below 7 is ten times more acidic than the next highest number
    - Ex. A solution with a pH 4 is 10 times more acidic than a pH 5 solution
    - Ex. A solution with a pH 4 is 100 times more acidic than a pH 6 solution

10

## The pH Scale



- Each whole pH value above 7 is ten times more basic than the previous smaller number
  - Ex. A solution with a pH 10 is 10 times more basic than a pH 9 solution
  - Ex. A solution with a pH 10 is 100 times more basic than a pH 8 solution

11

## pH of Everyday Items



- Organize these items as either an acid, a base, or neutral
- Going the Extra Step: order these items in increasing pH

Battery Acid	Coffee	Baking Soda
Bleach	Soap	Tomato
Acid Rain	Drain Cleaner	Apple Juice
Pure Rain	Soda	Milk
Blood	Stomach Acid	Pure Water

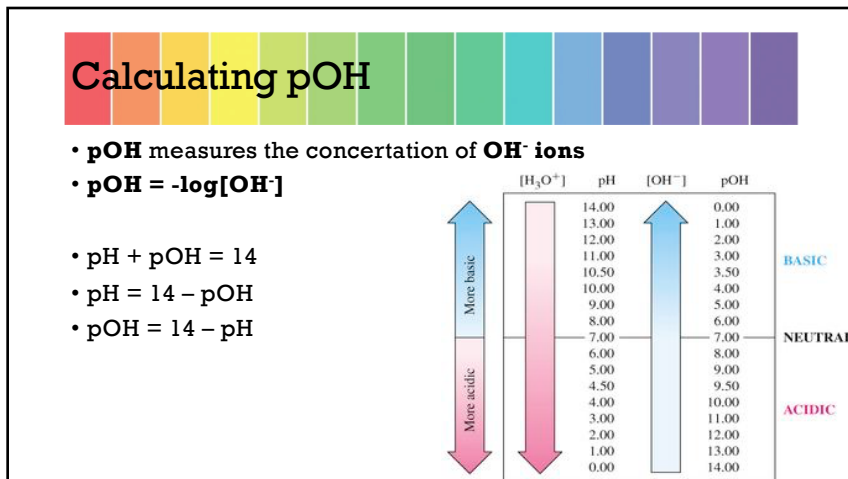
12



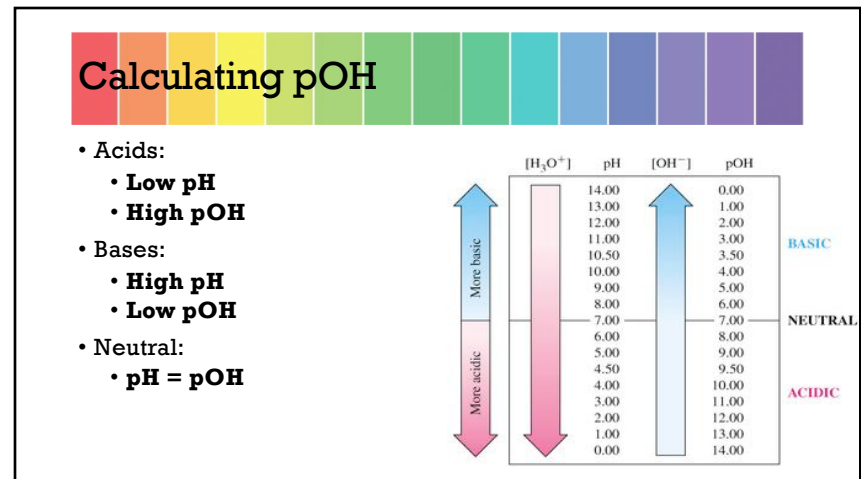
13



14



15



16



## Calculating pOH: Example

- If the pH of  $\text{H}_2\text{SO}_4 = 3.78$ , what is the pOH?
  - $\text{pOH} = 14 - \text{pH}$
  - $\text{pOH} = 14 - 3.78$
  - $\text{pOH} = 10.22$
- Based on the pH scale, is this an acid or a base? Why?
  - An acid because the pH is less than 7

17



## Calculating pOH: Examples – Your Turn

- What is the pOH of HBr if the pH is 1.52? Based on the pH scale, is this an acid or a base? Why?
  - $\text{pOH} = 14 - \text{pH}$
  - $\text{pOH} = 14 - 1.52$
  - $\text{pOH} = 12.48$
  - **Acid because  $\text{pH} < 7$**
- What is the pH of HCl if the pOH is 10.5? Based on the pH scale is this an acid or a base? Why?
  - $\text{pH} = 14 - \text{pOH}$
  - $\text{pH} = 14 - 10.5$
  - $\text{pH} = 3.5$
  - **Acid because  $\text{pH} < 7$**

18



## pH Scale Checkpoint Questions

- Question #1:
- An acidic solution can have a pH of \_\_\_\_\_.
  - 7
  - 10
  - 3
  - 14
- 3. An acid has a pH of less than 7

19



## pH Scale Checkpoint Questions

- An aqueous solution that has a hydrogen ion concentration of  $1.0 \times 10^{-8}$  moles per liter (M) has a pH of \_\_\_\_\_.
  - 6, which is basic
  - 6, which is acidic
  - 8 which is basic
  - 8 which is acidic
- 8 which is basic because the exponent will tell you the pH if you can't use logs on a calculator and bases have pH values that are greater than 7

20

## pH Scale Checkpoint Questions

- What is the pH of 0.00001 molar HCl solution?
  - 1
  - 9
  - 5
  - 4
- 5 because if you plug in  $-\log(0.00001)$  you get 5 or if you convert 0.00001 to scientific notation, you get  $1.0 \times 10^{-5}$  and the exponent tells you the pH value

21

## pH Scale Checkpoint Questions

- A basic solution can have a pH of \_\_\_\_\_.
  - 4
  - 14
  - 3
  - 1
- 14 because a base has a pH greater than 7

22

## pH Scale Super Summary Chart

pH Change	$[\text{H}_3\text{O}^+]$ increase or decrease	$[\text{OH}^-]$ increase or decrease	More acidic or more basic?	By a factor of...
6 to 8				
8 to 5				
3 to 7				
11 to 9				
14 to 13				
4 to 8				

23