Name _____

Date _____

Investigating the pH Scale

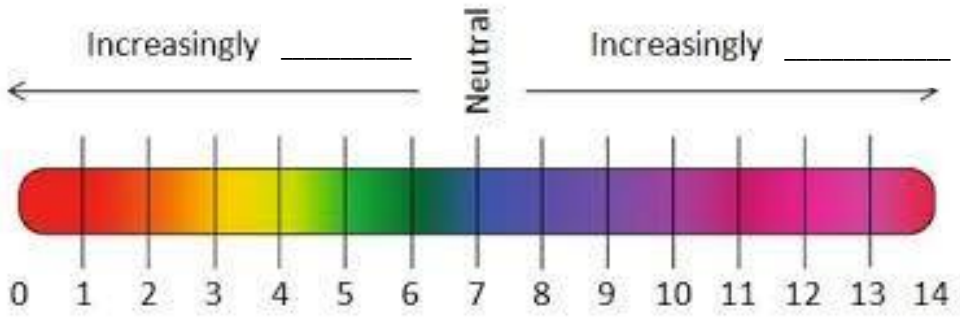
Essential Question:

How does the pH scale qualitatively relate to acids, bases, hydronium ion and hydroxide ion concentrations?

1. Go to phet.colorado.edu and click on Play with Simulations. On the left hand side of the screen pick Chemistry and then find the simulation that says "pH Scale." (Don't choose pH Scale: Basics)

Macro Investigation

2. Click on the "Macro" box.
3. There is a pH scale on the left hand side of the screen. Label the pH scale below as **acidic** and **basic**.



4. Investigate the pH of each of the following substances.
   a) Drag the pH sensor into the solution to see the pH reading.
   b) Record the pH of the substance and whether the substance falls into the acid or base end of the pH scale.
   c) To change the substance simply select from the drop down menu.

Substance	pH	acid/base
Drain cleaner		
Hand soap		
Blood		
Spit		
Milk		
Chicken Soup		
Coffee		
Orange Juice		
Soda Pop		
Vomit		
Battery Acid		

5. Using the information from the chart and simulation answer the following questions.

a) What pH values correspond to acids? _____

b) What pH values correspond to bases? _____

Micro Investigation

6. Navigate to the "Micro" box.

7. The same substances that were on the previous tab (Macro) are in this tab. However this tab gives you additional information. Click on the H_3O^+/OH^- ratio box located below the beaker with the substance.

8. Fill in the chart below for each substance listed.

Substance	pH	Acid or Base?	Concentration (mol/L)			Particulate Level View More H_3O^+ or OH^-?
			H_2O	H_3O^+	OH^-	
Drain Cleaner						
Hand Soap						
Coffee						
Vomit						
Battery Acid						
Blood						

9. Using the information from the chart and simulation answer the following questions.

a) As the pH approaches 0, what happens to the **concentration of H_3O^+ ions**? _____

b) As the pH approaches 0, what happens to the **concentration of OH^- ions**? _____

c) As a solution becomes **more acidic** what is the relationship between H_3O^+ and OH^- ions? (<, >, or =)

H_3O^+ _____ OH^-

d) As the pH approaches 14, what happens to the **concentration of H_3O^+ ions**? _____

e) As the pH approaches 14, what happens to the **concentration of OH^- ions?** _____

f) As a solution becomes **more basic** what is the relationship between H_3O^+ and OH^- ions? (<, >, or =)

H_3O^+ _____ OH^-

10. a) Can you predict the relationship between H_3O^+ and OH^- ions in a solution with a pH of 7?

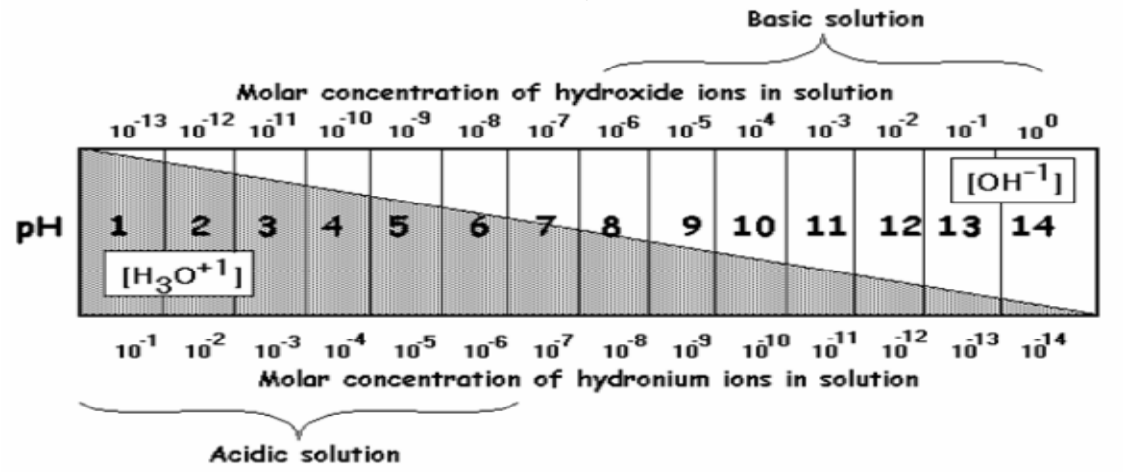
H_3O^+ _____ OH^-

b) Would you classify this solution as an acid or base? Explain your reasoning.

Determining pH and pOH

pH = - log**[H^+]** or pOH = - log**[OH^-]**

Examples: A solution with a [H_3O^+] of 1×10^{-6} has a pH of _____.



A solution with a [H^+] of 1×10^{-11} has a pH of _____ and is _____.

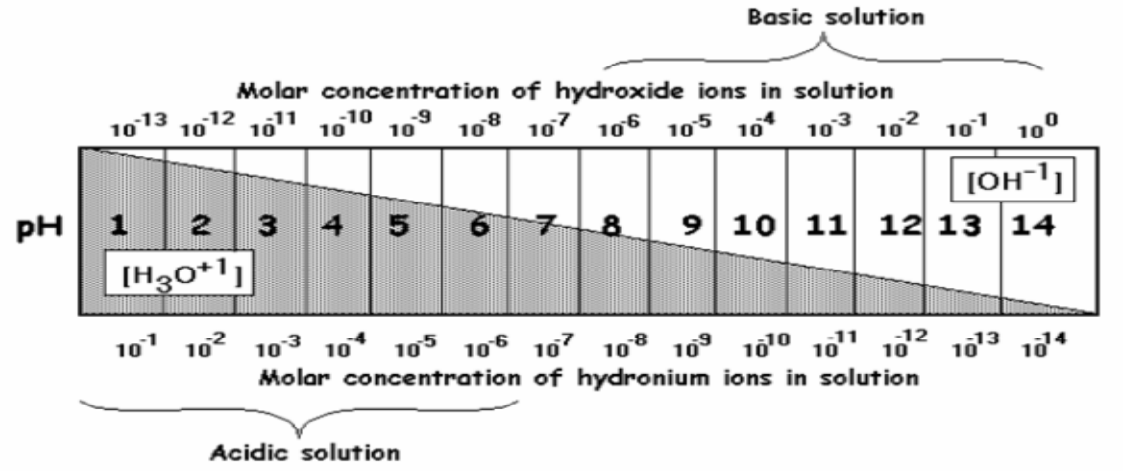
A solution with a [H+] of 1×10^{-3} has a pH of _____ and is _____.

A change of 1 in pH means there has been a _____x change in the concentration of H^+ ions

A change in pH from 3 to 4 means there are _____ times _____ [H^+] ions in solution.

A change in pH from 10 to 8 means there are _____ times _____ [H^+] ions in solution.

A change in pH from 1 to 4 means there are _____ times _____ [H^+] ions in solution.



pOH + pH = 14 and **$[H^+][OH^-] = 1.0 \times 10^{-14}$**

1. Determine the following values:

Example: 1×10^{-12} M If the $[OH^-] = 1 \times 10^{-2}$ M for a solution, calculate the $[H_3O^+]$

_____ a. if the $[H_3O^+] = 1 \times 10^{-6}$ M for a solution, calculate the $[OH^-]$

_____ b. if the $[H_3O^+] = 1 \times 10^{-9}$ M for a solution, calculate the $[OH^-]$

_____ c. if the $[OH^-] = 1 \times 10^{-12}$ M for a solution, calculate the $[H_3O^+]$

_____ d. if the $[OH^-] = 1 \times 10^{-3}$ M for a solution, calculate the $[H_3O^+]$

_____ e. The $[H_3O^+]$ and $[OH^-]$ are _____(directly, inversely, not) proportional in any system involving water

2. Determine the following values

_____ a. If the pH = 2.0 for a solution, calculate the pOH

_____ b. If the pOH = 4.73 for a solution, calculate the pH

_____ c. If the $[H_3O^+] = 1 \times 10^{-3}$M for a solution, calculate the pOH

_____ d. If the pOH = 5.0 for a solution, calculate the $[H_3O^+]$

_____ e. If the pH = 1.0 for a solution, calculate the $[OH^-]$