Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Block \_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_\_

**Introduction to Acids & Bases**

We have all heard about acids and bases, but what makes a solution acidic or basic? What do we mean by pH?

The purpose of this activity is to investigate the differences between acidic and basic solutions on a molecular level.

Go to the PhET simulation named “pH scale.” Take a few moments to play around with the simulation to see what the various buttons are.

Choose the “Macro” screen.

# Look at the scale to the left.

## What does it measure? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## Which numbers represent an acidic solution? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## Which numbers represent a basic solution? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## A solution that is neither acidic nor basic is called “neutral”. What is the pH of a neutral solution? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

# Look at the list of solutions. List them from the lowest pH to the highest pH. List the pH and indicate if the solution is acid, basic, or neutral.

|  |  |  |
| --- | --- | --- |
| **Solution** | **pH** | **Acidic/basic/neutral** |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

# What is the meaning of pH? Choose the “micro” screen from the options at the bottom of the page.

## What are the three quantities measured by the scale on the left? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## Toggle the top scale to concentration.

### What are the units of concentration? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Remember from the last chapter. What is another name for these units? \_\_\_\_\_\_\_\_\_\_\_\_

## The switch below the scale should read logarithmic. What is the range of values for concentration? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

#### Change these values to standard notation (without the exponent)

### Which is the largest number on the scale (as an exponent)?\_\_\_\_\_\_\_\_\_\_\_\_\_ The smallest? \_\_\_\_\_\_\_\_\_\_\_\_

## The substances in the boxes are H2O, H3O+ and OH-. Relate these three substances in a balanced chemical equation.

## Change the solutions and look at the concentration values. Which concentration level always stays constant? \_\_\_\_\_\_\_\_\_\_\_\_\_

## How are the concentration values of the other two substances related?

## Now, pick out two acidic solutions and two basic solutions from the previous chart. Indicate which is higher, the H3O+ concentration or the OH- concentration.

|  |  |  |
| --- | --- | --- |
| **Acidic/basic/neutral** | **solution** | **Which is higher, H3O+ or OH-?** |
| Acidic |  |  |
| Acidic |  |  |
| Basic |  |  |
| Basic |  |  |

## Change the logarithmic scale to linear. What do you notice about the position of the boxes on the scale? Why is a logarithmic scale preferred when measuring the concentration of H3O+ and OH-?

# Now, let’s see what is happening on a molecular level. Choose the “custom” screen from the options at the bottom of the page

## Let’s see how the pH is affected by these species. Move the sliders on the scale to make the pH read 1. Record the [H3O+] and [OH-]. Indicate if the solution is acidic, basic or neutral

|  |  |  |  |
| --- | --- | --- | --- |
| **pH** | **[H3O+]** | **[OH-]** | **Acidic/basic/neutral** |
| 1 |  |  |  |
| 3 |  |  |  |
| 5 |  |  |  |
| 7 |  |  |  |
| 9 |  |  |  |
| 11 |  |  |  |
| 13 |  |  |  |

## Look at the concentration values of H3O+ and OH-. Which one of these values relates to pH? How does it relate?

## In acidic solutions, which is greater? [H3O+] and [OH-]? Give an example.

## In basic solutions, which is greater? [H3O+] and [OH-]? Give an example.

## In neutral solutions, which is greater? [H3O+] and [OH-]? Give an example.

## Now, get out your calculator. Multiply the [H3O+] by the [OH-] for a few of the solutions. What do you notice?

# **Putting it together.** Use the information from the simulation to answer these questions.

## On a molecular scale, what is the difference between an acid and a base?

## In solutions, how are the [H3O+] and [OH-] related?

## What does pH measure?