**The pH Scale**

****Acidic, Basic, and Neutral Solutions

* Acid Solutions: (acid in water)
  + **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* Basic Solutions: (base on water)
  + **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* Neutral Solutions: (just water)
  + **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

pH: The Power of Hydronium [H3O+]

* The pH scale is used to measure the **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* Acidic solutions: **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* Neutral solutions: **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* Basic solutions: **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Measuring pH

* If [H+] = 1.0 x 10-4, the pH is 4
* The exponent gives you the pH
* At pH 4, [H+] = 1 x 10-4 M = 0.0001 M
* A solution with a pH of 3, [H+] = 1 x 10-3 M = 0.001 M
* When the pH decrease by **\_\_\_\_\_\_\_\_\_\_\_\_**, the concentration of hydrogen ions increase by a factor **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

The pH Scale

* Measures how acidic or basic a substance is
* Ranges from **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
  + **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** – [H3O+] or [H+] = [OH-]
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
  + **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ –** [H3O+] or [H+] > [OH-]
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
  + **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** – [H3O+] or [H+] < [OH-]
  + Basic = **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* The pH system is **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**, 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
  + 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

Calculating pOH

* **\_\_\_\_\_\_\_\_\_\_\_\_** measures the concertation of **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** pH + pOH = 14
* pH = 14 – pOH
* pOH = 14 – pH

|  |  |  |
| --- | --- | --- |
| Acids   * \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ * \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | Bases   * \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ * \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | Neutral   * \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

Calculating pOH: Example

* If the pH of H2SO4 = 3.78, what is the pOH? Based on the pH scale, is this an acid or a base?  Why?
* 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?
* 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?

pH Scale Checkpoint Questions

1. An acidic solution can have a pH of \_\_\_\_.
   1. 7
   2. 10
   3. 3
   4. 14
2. An aqueous solution that has a hydrogen ion concentration of 1.0 x 10-8 moles per liter (M) has a pH of \_\_\_\_\_\_\_.
   1. 6, which is basic
   2. 6, which is acidic
   3. 8 which is basic
   4. 8 which is acidic
3. What is the pH of 0.00001 molar HCl solution?
   1. 1
   2. 9
   3. 5
   4. 4
4. A basic solution can have a pH of \_\_\_\_\_.
   1. 4
   2. 14
   3. 3
   4. 1

pH Scale Super Summary Chart

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **pH Change** | **[H3O+] increase or decrease** | **[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 |  |  |  |  |