# *ACID-BASE NEUTRALIZATION*

**Acid – base neutralization occurs when all the H3O+ ions from the acid have combined with all the OH- ions from the base. This is a double replacement reaction.**

**ACID + BASE 🡪 SALT + WATER**

Write the balanced equation for each of the following neutralization reactions:

1. nitric acid reacts with sodium hydroxide

2. sulfuric acid reacts with sodium hydroxide

3. phosphoric acid reacts with barium hydroxide

***The pH Scale***

Pure water ionizes to a very slight extent!!! (1/500 million molecules will ionize.) This is called the self-ionization of water.

In pure water, the concentration of H3O+ will always equal the concentration of OH-. From now on, we will express the concentration (molarity) of something in [ ].

Very careful measurements (with sensitive instrumentation) have shown that in pure water at 25ºC,

**Kw**  is called the **ion product constant for water**.

This expression is true for **pure water** and **dilute aqueous solutions** at 25 ºC.

Ex. An aqueous solution has a [H+] = 2.5 x 10-12M. What is the [OH-]?

Expressing acidity and basicity in terms of [H3O+] and [OH-] can be difficult because the values are sometimes small. The pH scale was developed for convenience.

0---1---2---3---4---5---6---7---8---9---10---11---12---13---14

The pH scale is a log scale based on 10, where

**pH = -log[H+]**

Ex. Tomato juice has a [H+] = 2.3 x 10-3 M. What is the pH of the juice? Is it acidic, basic or neutral?

Sig fig rule for pH: Sig figs in the concentration = decimal places in the pH

Decimal places in the pH = sig figs in the concentration

Similar log scales are used for representing other quantities, for example:

**pOH = -log[OH-]**

**pH + pOH = 14**

If you are given the pH and asked to find the concentration, you can take the antilog (10x):

[H+] = 10-pH

[OH-] = 10-pOH

**Practice Problems**

1. The [H+] (or [H3O+]) of a solution is 8.75 x 10-5M.
   1. What is the pH of the solution?
   2. What is the pOH of the solution?
   3. Is the solution acidic, basic or neutral?
   4. What is the [OH-]?
2. A solution of 0.65M H2SO4 aqueous solution is made.
   1. Write the ionization equation.
   2. Find the [H+].
   3. Find the [OH-].
   4. Calculate the pH. Acidic, basic or neutral?
   5. Calculate the pOH.
3. A solution of 0.15M NaOH aqueous solution is made.
   1. Write the dissociation equation.
   2. Find the [H+] and [OH-].
   3. Calculate the pH.
   4. Calculate the pOH.
   5. Acidic, basic or neutral?
4. Acetic acid is a weak acid, HC2H3O2, and has 5% ionization. Calculate the [H+], [OH-], pH, and pOH of a 0.35 M solution of acetic acid.