Difference Between pH and pOH

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Key Difference - pH vs pOH

The terms pH and pOH are used to express the amounts of H^+ and OH^- ions present in an aqueous solution. These expressions are given as minus log values of the concentration of solute. pH refers to the "potential of hydrogen". It can be used to determine whether a solution is acidic, basic or neutral. In contrast, pOH is a measure of hydroxide ion (OH^-) concentration. The **key difference** between pH and pOH is that **pH is a measure of hydrogen ions whereas pOH is a measure of hydroxide ions**.

What is pH?

pH is a figure expressing the acidity or alkalinity of a solution on a logarithmic scale on which 7 is neutral. The values lower than 7 are more acidic while higher values more alkaline. The pH is equal to $-\log_{10} c$, where c is the hydrogen ion concentration in moles per litre.

The pH scale runs from 1 to 14. The pH values 1 to 6 is recognized as acidic pH values. The pH values from 8 to 14 are recognized as basic pH values. The pH 7 is considered as the neutral pH. For example, strong acids have a pH value near pH=1 whereas strong bases have pH values near pH=14. The "p" in the term pH refers to the negative logarithm. In general, the negative logarithm of the hydrogen ion concertation (or pH) is used instead of using the concentration of hydrogen ions. That is because, most of the times, the concentrations of hydrogen ions is very low or very large, thus, using pH makes it easier to work with such small or large values.

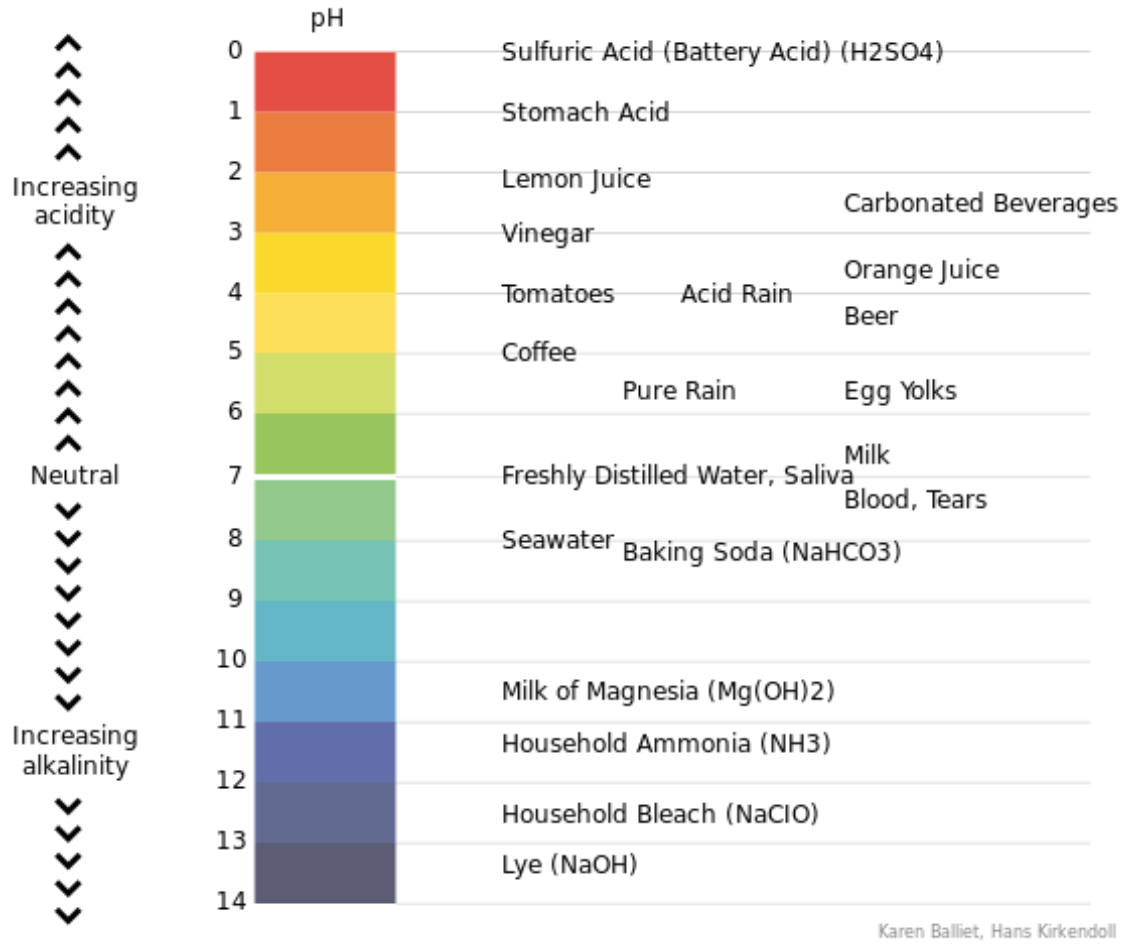

Figure 01: pH Scale

In aqueous solutions, the water molecules dissociate into hydrogen ions and hydroxide ions. Hence, all natural water bodies have a certain pH value. The pH of a system is given by the following equation.

$$pH = -\log_{10}[H^+]$$

There are indicators known as pH indicators that are used to indicate the endpoint of an acid-base reaction. These indicators are able to change the colour of the reaction medium with the changes of pH. For example, phenolphthalein indicator has a pink colour in basic pH values (about pH=10.0), but it is colourless at around pH=8.3.

What is pOH?

pOH is a measure of hydroxide ion (OH^-) concentration. Hence, pOH is a measure of the alkalinity of a solution. The “p” in the term pOH refers to the negative logarithm. hence the pOH is the negative logarithm of hydroxide ion concentration in a solution.

$pH = -\log_{10}[OH^-]$

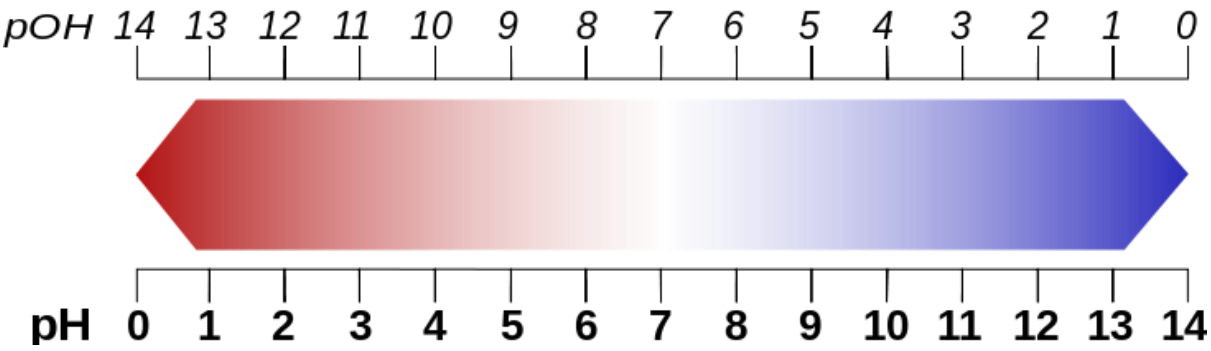

Figure 02: Comparison of pH and pOH Scales

Since this term gives the number of hydroxide ions present in an aqueous solution, it is a measure of basicity (alkalinity). For example, pOH values less than pOH= 7 (at 25°C) are alkaline. Then, if a solution has a pOH value in between 1 to 6, the solution is more alkaline. pOH=7 is considered as neutral. But pOH values higher than 7 are recognized as acidic conditions.

What is the Relationship Between pH and pOH?

For the dissociation of water, the dissociation constant is given as below.

$H_2O \leftrightarrows H^+ + OH^-$

$K_w = [H^+][OH^-]$

Where kw is dissociation constant of water, $[H^+]$ is hydrogen ion concertation and$[OH^-]$ is hydroxide ion concentration. But for pure water, $[H^+] = [OH^-] = 1x10^{-7}$mol/L. then, when the negative logarithms are taken for each term in the above equation,

pKw = pH + pOH

pKw = 7 + 7

pKw = 14

then if only the pH is known, the pOH value can be obtained sing above relationship.

However, in both pH and pOH scales, 7 is neutral.

What is the Difference Between pH and pOH?

pH vs pOH

pH expresses the acidity or alkalinity of a solution on a logarithmic scale on which 7 is neutral.	pOH is a measure of hydroxide ion (OH^-) concentration. pOH=7 is considered as neutral
Expression	
pH gives the negative logarithm of hydrogen ion concentration.	pOH gives the negative logarithm of hydroxide ion concentration.
Acidic Values	
pH scale gives acidic values from 1 to 6.	pOH scale gives acidic values from 8 to 14.
Alkaline Values	
pH scale gives basic values from 8 to 14.	pOH scale gives basic values from 1 to 6.

Summary - pH vs pOH

pH and pOH are two terms used to express the acidity or alkalinity of a solution. The main difference between pH and pOH is that pH is a measure of hydrogen ions whereas pOH is a measure of hydroxide ions.

Reference:

1.Helmenstine, Anne Marie, D. "pOH Definition (Chemistry)." ThoughtCo, Jul. 24, 2017. Available here
2.Helmenstine, Anne Marie, D. "How to Find pOH in Chemistry." ThoughtCo, Jan. 29, 2018. Available here
3.Definition of pH, pOH, pKw. Available here

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