

## pH Scale

### Introduction and Definitions:

Acidic and basic are two extremes that describe a chemical property chemicals. Mixing acids and bases can cancel out or neutralize their extreme effects. A substance that is neither acidic nor basic is neutral.

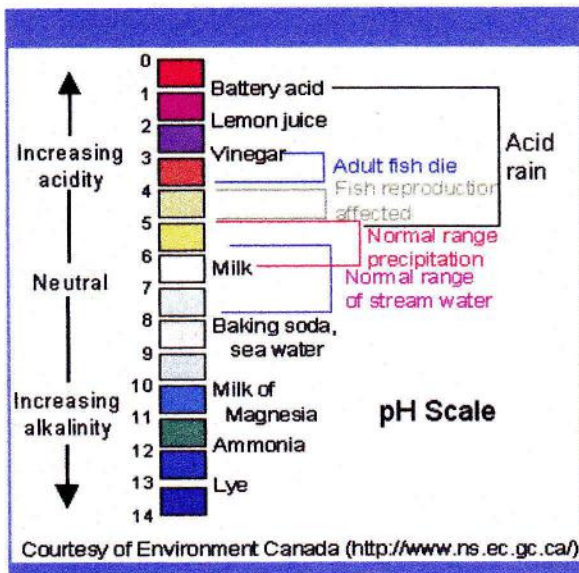
The pH scale measures how acidic or basic a substance is. The pH scale ranges from 0 to 14. A pH of 7 is neutral. A pH less than 7 is acidic. A pH greater than 7 is basic.

The pH scale is logarithmic and as a result, each whole pH value below 7 is ten times more acidic than the next higher value. For example, pH 4 is ten times more acidic than pH 5 and 100 times (10 times 10) more acidic than pH 6. The same holds true for pH values above 7, each of which is ten times more alkaline (another way to say basic) than the next lower whole value. For example, pH 10 is ten times more alkaline than pH 9 and 100 times (10 times 10) more alkaline than pH 8.

Pure water is neutral. But when chemicals are mixed with water, the mixture can become either acidic or basic. Examples of acidic substances are vinegar and lemon juice. Lye, milk of magnesia, and ammonia are examples of basic substances.

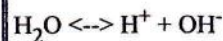
Practice:

$\text{HNO}_3 + \text{KOH} \rightarrow$	Answer <input type="text"/>	+	Answer <input type="text"/>
$\text{H}_3\text{PO}_4 + 3 \text{NaOH} \rightarrow$	Answer <input type="text"/>	+	Answer <input type="text"/>



### Ionization of Water:

Water molecules exist in equilibrium with hydrogen ions and hydroxide ions.



The water equilibrium constant is written as:

$$K_w = [\text{H}^+][\text{OH}^-]$$

Experimentally, it has been found that the concentration of:

$$\text{H}^+ = \text{OH}^- = 10^{-7}$$

Therefore:  $K_w = [10^{-7}][10^{-7}] = [10^{-14}]$   
(To multiply exponential numbers - simply add the exponents.)

The values for  $K_w$ ,  $\text{H}^+$ ,  $\text{OH}^-$  concentration all indicate that the equilibrium favors the reactant (water molecules). In other words, only very small amounts of