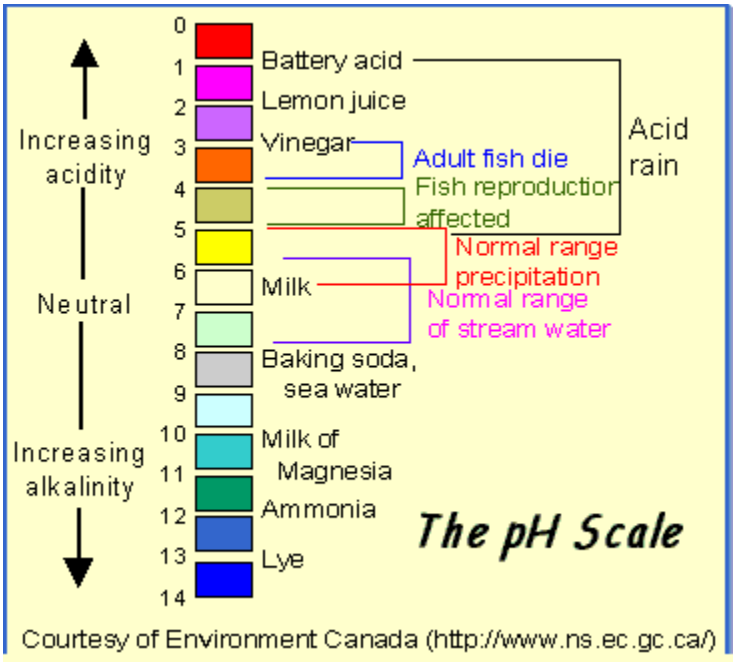
What is pH?



Drinking Water and Water Quality Helpguide - Free Information

Stream and Watershed Management and Monitoring

Phosphate and Nitrogen in the Environment

Baseline Water Testing and Informational Water Testing

Lake and Pond Water Testing

Drinking Water Treatment System for pH Problems

pH is one of the most common water quality tests performed. pH indicates the sample's acidity, but is actually a measurement of the potential activity of hydrogen ions (H+) in the sample. pH measurements run on a scale from 0 to 14, with 7.0 considered neutral. Solutions with a pH below 7.0 are considered acids. Solutions with a pH above 7.0, up to 14.0 are considered bases. All organisms are subject to the amount of acidity of stream water and function best within a given range.

The pH scale is logarithmic, so every one-unit change in pH actually represents a ten-fold change in acidity. In other words, pH 6.0 is ten times more acidic than pH 7.0; pH 5 is one hundred times mores acidic than pH 7.0.

What causes the pH of a stream to vary?

The pH of a body of water is affected by several factors. One of the most important factors is the bedrock and soil composition through which the water moves, both in its bed and as groundwater. Some rock types such as limestone can, to an extent, neutralize the acid while others, such as granite, have virtually no effect on pH.

Another factor which affects the pH is the amount of plant growth and organic material within a body of water. When this material decomposes carbon dioxide is released. The carbon dioxide combines with water to form carbonic acid. Although this is a weak acid, large amounts of it will lower the pH.

A third factor which determines the pH of a body of water is the dumping of chemicals into the water by individuals, industries, and communities. Remember - something as "harmless" as shampoo rinse water is actually a chemical brew and can affect the pH along with other chemical parameters of water. Many industrial processes require water of exact pH readings and thus add chemicals to change the pH to meet their needs. After use, this altered pH water is discharged as an effluent, either directly into a body of water or through the local sewage treatment plant.

A fourth factor which affects pH is the amount of acid precipitation that falls in the watershed. Acid rain is caused by nitrogen oxides (NOx) and sulfur dioxide (SO_2) in the air combining with water vapor. These pollutants are primarily from automobile and coal-fired power plant emissions. Acid rain is responsible for many of our first order streams becoming acidic. Serious problems can occur in spring when streams receive a massive acid dose as acidic snows melt.

A fifth factor stems from coal mine drainage. Iron sulfide, a mineral found in and around coal seams, combines with water to form sulfuric acid. This acid, ferrous oxide (known as "yellow boy"), and huge quantities of silt are the major pollutants from coal mining. Combined with the problem of acid rain, the pH of some stream waters can be drastically lowered.

Synergistic effects of pH

Synergy is the process whereby two or more substances combine and produce effects greater than their sum. For example, 2 + 2 = 4 (mathematically). But **synergistically**, 2 + 2 = *much more* than 4! Synergy is a mathematical impossibility but it is a chemical reality. Here's how it works.

When acid waters (waters with low pH values) come into contact with certain chemicals and metals, this often makes them more poisonous than normal. As an example: fish that usually can withstand pH values as low as 4.8 will die at pH 5.5 if the water they're swimming in contains as little as 0.9 mg/L of iron. Mix an acid water with small amounts of aluminum, lead, or mercury, and you have a similar problem - one that far exceeds the usual dangers of these substances. Heavy metals can accumulate on the gills of fish or cause deformities in young fish, reducing their chance of survival.

How pH affects aquatic life

Changes in the pH value of water are important to many organisms. Most organisms have adapted to life in water of a specific pH and may die if it changes even slightly. This is especially true of aquatic macroinvertebrates and fish eggs and fry.

The pH is a critical factor determining the health of a waterway. The factors that control it are obviously complicated. As with many environmental concerns, we need to be aware of the implications of any impacts we have upon the environment.