

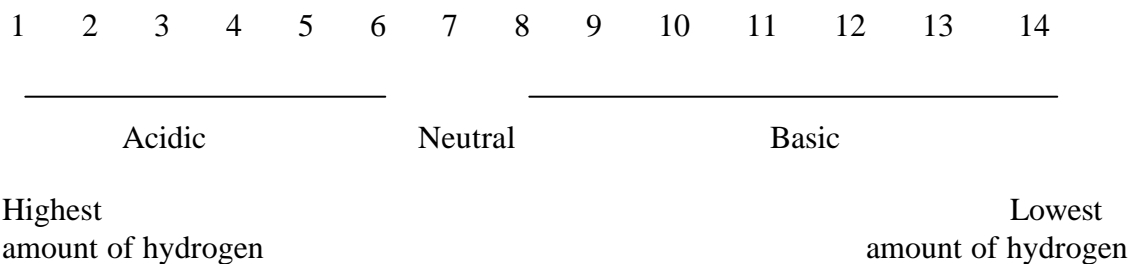
pH and Alberta Streams and Rivers

Highlights

- Normal range for pH in Alberta streams and rivers is generally between 7 and 9
- pH higher or lower than the normal range can result in decreases in aquatic species.
- Factors that influence pH
 - Carbon dioxide in the atmosphere
 - Events or disturbances in the watershed
 - Human activities
- Generally natural pH in streams and rivers is fairly stable.

What is pH?

pH is measured on a scale of 1 to 14. Strongly acidic solutions are assigned a value of 1. Strongly basic solutions are assigned a value of 14. Neutral solutions are assigned a value of 7. When the pH is less than 7 the solution is acidic. When the pH is 7, the solution is neutral. When pH is above 7 the solution is basic



The degree of pH is determined by the amount of hydrogen (ions) in a solution. Solutions with a high amount of hydrogen (ions) are acidic. Solutions with a low amount of hydrogen (ions) are basic or alkaline.

Each time the number increases on the pH scale the amount of hydrogen (ions) decrease by ten times (as pH numbers increase, hydrogen ions decrease).

Examples

- ❑ A pH of 2 has 10 times less hydrogen than a pH of 1.
- ❑ A pH of 3 has 10 times less hydrogen than a pH of 2.

What is a pH test?

A pH test determines the concentration of hydrogen ions in a solution in order to give an indication of the solution's acidity.

For the pH test in the Alberta Water Quality Monitoring Day kit, tablets are added to a sample of water. These tablets cause a reaction and the water sample will change color based on the amount of hydrogen (ions) in the sample. By comparing the color of the sample to a color-coded chart in the kit, the pH of the sample can be determined.

This color-based pH test is the most simple and inexpensive method for getting and indication of pH in a sample.

What is the normal range of pH in Alberta?

The rocks and minerals in an area (geology) strongly influence the natural pH of surface water. Over time, the bedrock and soil in a given area will weather. As rainwater flows over land, it picks up and dissolves minerals. As the water drains into rivers and streams the minerals contained in it are also transported to the rivers and streams.

Most streams and rivers in Alberta are located in areas that have a lot of carbonate –rich deposits and soils that were deposited a long time ago by glaciers. These streams and rivers tend to be alkaline and have a pH of between 7 and 9. In contrast, rivers and streams in the far northeast area of the province tend to have a pH slightly below 7. This area has different geology. It is Canadian Shield and is mainly composed of carbonate-poor, hard, igneous rock such as granite.

In general, natural pH in streams and rivers is fairly stable, however there is a high human use demand on Alberta rivers by industry, municipalities and agriculture. Effluents and discharges from these users can impact pH.

Why is pH important?

Most aquatic organisms can only survive within a certain pH range. Generally, the more neutral the pH, the greater the number and variety of organisms that can survive. Water with a pH of 6.5 to 8.5 is suitable for most aquatic organisms. If pH moves either higher or lower, the number of individuals and the number of species will decline

Water quality is greatly affected by pH. Of greatest concern is the influence of pH on the solubility of common metal elements. With decreasing pH, metals become increasingly solubilized (mobilized) and available for uptake by aquatic organisms. In dissolved form, metals can cause extreme physiological damage to most forms of aquatic life and thus most plants and animals tend to be very sensitive to pH and are intolerant of pH below 5.7. Few organisms can survive below a pH of 4. Again, due to the predominance of carbonate-rich sedimentary rock and soils, most rivers and streams in Alberta tend to be alkaline. High pH levels can also be toxic and most aquatic organisms are intolerant of environments with pH greater than 9. While the pH of Alberta's rivers and streams can decrease below 7 or increase above 9 on occasion, these episodes are usually very short in duration before retuning to the normal range.

What influences pH in streams and rivers?

As indicated above, the **geology** of an area affects the natural pH of rivers and streams. Another natural factor affecting pH is **carbon dioxide in the atmosphere**. As carbon dioxide mixes with water it lowers pH (increases acidity). However, since Alberta's surface waters tend to be alkaline, atmospheric carbon dioxide has little effect on overall pH levels

Other **events or disturbances** in the watershed may also affect pH. As water percolates through the soil, it absorbs minerals. Eventually this water can drain into rivers and other surface water bodies. Increased amounts of water during snowmelt or heavy rain can lead to greater mineral absorption, which may affect the pH in a river or stream.

Similarly, **human activities** such as accidental spills, agricultural runoff (pesticides, fertilizers, soil leachates), sewer overflow and discharge of chemicals by communities and industries can have significant effects on pH levels. Lastly, atmospheric release of sulphur and nitrogen oxides can mix with rain to produce acid rain that can have severe negative impacts on surface waters.

Electricity and pH

The majority of electricity generated in Alberta is produced through burning coal. The emissions produced by burning coal contain nitrogen and sulfur oxides. They combine in the atmosphere to produce sulfuric acid. This product can then end up in rivers and streams through precipitation (acid rain) and cause a decrease in pH (increased acidity).