

pH

What is pH?

The pH of water is a measurement of how **acidic** or how **basic** the water is. We measure pH on a scale of 0 to 14. Many substances dissolve in water. Sometimes when substances dissolve, they produce charged molecules called ions. Acidic water contains extra positive ions (H⁺). Acidic water has pH values between 0 and 7, zero being the most acidic. Basic, or alkaline, water contains extra negative ions (OH⁻). Basic water has pH values between 7 and 14, 14 being the most basic.

You might expect rainwater to be neutral. In fact, it is somewhat acidic with a pH of 5 to 6. This is due to the formation of carbonic acid as rain interacts with CO₂.

Look at the pH table below. Notice that substances that are highly acidic or basic, such as battery acid and lye, are toxic to most organisms. Refer back to this chart when you interpret your pH sample values.

The pH Scale



Why do we care?

Animals and plants

Most aquatic animals and plants have adapted to life in water with a specific pH and may suffer from even a slight change.

- Even moderately acidic waters (low pH) may reduce the hatching success of fish eggs, irritate fish and aquatic insect gills and damage membranes.
- Water with extremely high or low pH is deadly. All fish die at a pH below 3 or above 9. Caddisflies die at a pH below 4.
- Amphibians are particularly vulnerable, probably because their skin is so sensitive to pollutants. Some scientists believe the recent drop in amphibian numbers around the world is due to low pH levels caused by acid rain.

Other chemicals in the water

A change in the pH of water can alter the behavior of other chemicals in the water. The altered water chemistry may affect aquatic plants and animals.

- For example, ammonia (a form of nitrogen) is harmless to fish in water that is not acidic. But, as pH decreases ammonia becomes toxic.
- A lower pH will cause heavy metals such as lead to dissolve more easily. Many heavy metals become toxic when dissolved in water.

How do we interpret our results?

Natural pH levels vary between 6.5 and 8.5, depending on the surrounding soil and vegetation.

If your pH value falls out of this range ask these questions:

- Did we perform the test correctly? Re-read the pH directions to ensure you sampled properly.
- Is it summer time? Water containing many aquatic plants may have raised pH values on summer afternoons because of the plant photosynthesis.
- Does our watershed contain a lot of rock (minerals can be acidic), dense conifer forests (conifer needles are acidic), or acidic soil? If so, you are likely to have relatively acidic waters.
- Does our stream have a lot of snow melt in it? Snow melt will lower pH values.
- If you answered “no” to these questions then take a look at your watershed. Are there land use practices that might be affecting the pH of your stream like pollution or mining?

Alkalinity

What is alkalinity?

The alkalinity of water is a measure of how much acid it can neutralize. If any changes are made to the water that could raise or lower the pH value, alkalinity acts as a buffer, protecting the water and its life forms from sudden shifts in pH. This ability to neutralize acid is particularly important in regions affected by acid rain. In water bodies with low alkalinity, when acid rain falls, it is not neutralized, so the pH of the water decreases. This drop in the pH level can harm or even kill some of the aquatic organisms in the water body.

Alkalinity should not be confused with pH. pH of a solution is a measure of the concentration of acid, or H⁺ ions, in the water. Alkalinity is the measure of the water's **capacity to neutralize acid**, or H⁺ ions, thereby keeping the pH at a fairly constant level.

Why do we care?

- Alkalinity protects the water from changes in pH.
- Sources of naturally occurring alkalinity include leaching from rocks (limestone), minerals (dolomite, calcite) and soil.

How do we interpret our results?

For protection of aquatic life, the alkalinity should be in the range of 100 to 250 ppm to be considered normal.

- If alkalinity is too low, it will not be able to protect the stream from changes in pH.
- If the alkalinity of water is too high, the water can be cloudy, which inhibits the growth of underwater plants.
- High alkalinity raises the pH level, which in turn harms or kills fish and other river organisms.