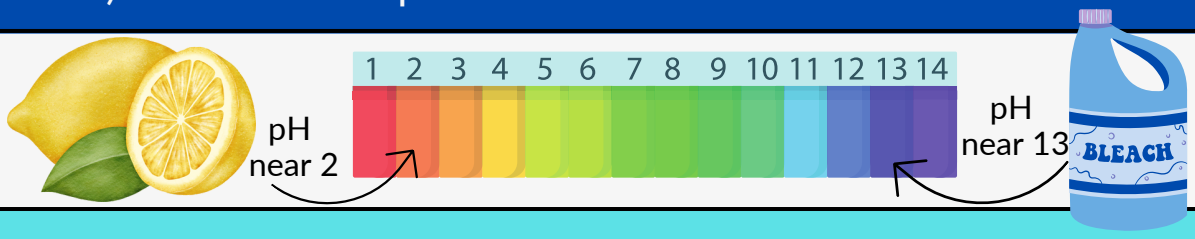
pH

Community Science Institute
Partnering with Communities to Protect Water

WHAT IS pH?

pH is a measure of how acidic or basic a water sample is. It can be thought of as the "potential of hydrogen" or "power of hydrogen." This is because on a chemical scale, the concentration of hydrogen ions (H^+) vs. hydroxyl ions (OH^-) determines how acidic or basic a solution is.

The pH scale runs from 1 (most acidic, like stomach acid) to 14 (most basic, like drain cleaner). Water with a pH of 7 is considered to be "neutral."



WHY DO WE MEASURE pH?

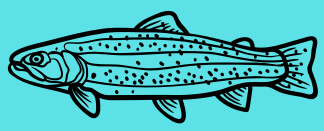
pH can be related to many other water quality indicators, making it an excellent general indicator.

Water that is *acidic*, or low in pH (<6 or 6.5), can make heavy metals (e.g. lead or copper) more soluble in the water. Low pH can also increase the toxicity of compounds like cyanides. Both of these changes can be harmful to aquatic life.

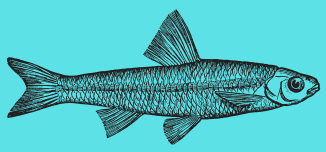
In water that is basic, or high in pH (above 9), ammonium (NH_4^+) converts to ammonia (NH_3), which is toxic if concentrated! Chronic exposure to high pH values can impact the sensory abilities of many fish.

Changes in pH can have natural causes, but more often they are a sign of industrial pollution of some sort. The following organisms can see sublethal effects at:

Daphnia sp. (water fleas)
pH under 4.5
pH over 10.3



Rainbow trout
pH under 5.5
pH over 9



Fathead minnows
pH under 6.5
pH over 9.8

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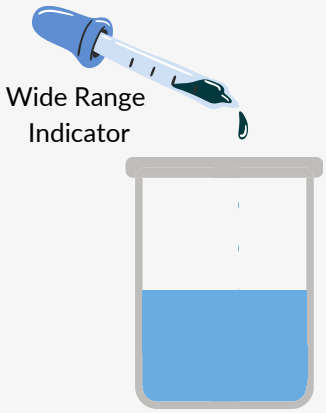
HOW DO WE MEASURE pH?

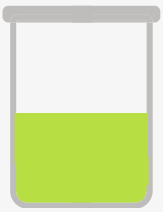
There are multiple ways to measure pH. In Community Science Institute's lab, we either use:

1. A chemical solution (called "Wide Range Indicator") that causes a color change OR
2. A pH probe.

Option 1: Wide Range Indicator

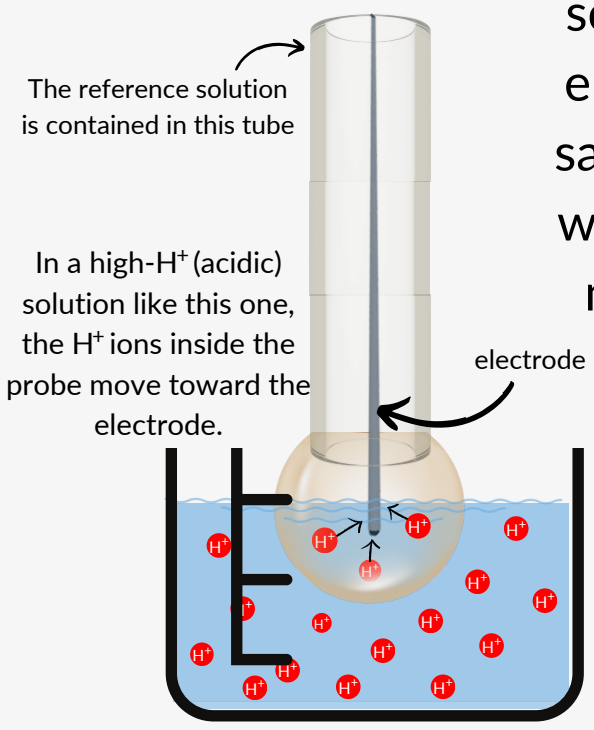


Wide Range Indicator is added to a water sample. The water changes color as the drops are added. To find the pH, the water is matched to a reference palette.



Can you tell what this sample's pH is?

Option 2: pH probe



A **pH probe** contains a reference solution (a solution with a known, neutral pH of 7) and an electrode. The probe is inserted into the water sample. Because the reference solution and the water sample are separated only by a thin glass membrane, the hydrogen ions (H^+) from each liquid respond to each other.

An acidic solution (high in H^+) prompts the H^+ ions inside the probe to move *away* from the membrane, while a basic solution (low in H^+) prompts them to move *toward* the membrane.

The electrode inside the probe senses these interactions and uses them to calculate the solution's pH.