

Understanding Acid Rain

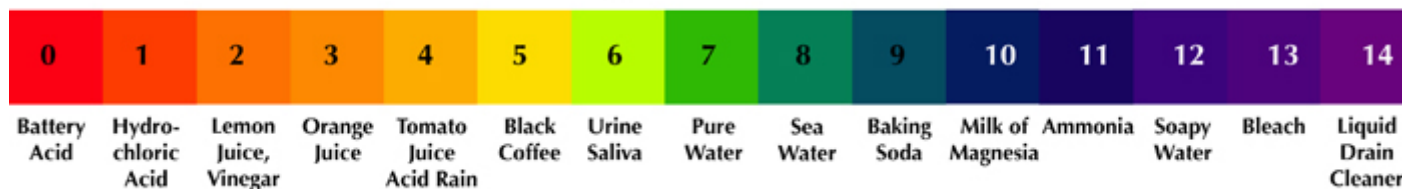
Read the Essay and Take the Short Answer Test

The acidity of a substance is referred to as its **pH** – which is the measurement of whether it is acidic or alkaline (base). The number scale used to measure pH is from 1 to 14 with 1 being the most acidic and 14 being the most alkaline (base). 7 is considered neutral, neither acid or base. In nature, everything has its own pH. For example, lemon juice or vinegar have a pH of 2. They are considered to be “acid.” While baking soda has a pH of 9 and bleach has a pH of 13. They are considered to be “base” or “basic” or “alkaline”. Compounds at either end of the pH scale are considered “*reactive*” and will burn the skin. Anyone who has had lemon juice squirt in your eye can attest to this.

Each level of the pH scale represents the power of 10. So if the pH of lemon juice is 2 and orange juice is 3, then lemon juice is 10 times more acidic than orange juice. Sulfuric acid measures 1 on the pH scale. It is 10 times more acidic than lemon juice and 100 times more acidic than orange juice (10 x 10).

Different kinds of natural communities can tolerate different levels of acid and base. Normal rain is slightly acidic naturally with a pH of 5.6. This is because the rain combines with carbon dioxide in the air. This makes a very mild form of carbonic acid naturally. The average pH of a healthy freshwater lake is about 6.5. If a lake receives too much acid rain and the pH begins to fall, fish, frogs and other lake animals may begin to die off.

pH Scale



Burning coal, oil and gasoline gives off sulfur, nitrogen and carbon into the air. These *emissions* combine with water vapor in the clouds and make acid – sulfuric, nitric and carbonic acid. These acidic clouds are carried by the wind, sometimes thousands of kilometers. The wind patterns of North America carry pollutants from busy cities, factories and industrial centers in the Midwest and drops them on the Northeastern U.S. and Canada. They fall to Earth as acid rain or snow.

How does this affect us?

- When acid rain falls into lakes and streams it can make the water so acidic that fish and frog eggs won't hatch.
- Acid rain can also cause buildings and statues to dissolve away.
- Acid rain leaches calcium out of conifer needles which makes them more susceptible to winter damage.
- Acid rain also leaches the calcium and magnesium from the soil. These components are called “base cations” which act as natural buffers in the soil, keeping it from being too acidic. Once they are gone, the aluminum in the soil dissolves and can be absorbed by trees and plants and acts as a toxin that damages them. In sugar maples the damage starts to show up as a die off in the top of the crown of the tree. The first sign of this is this area of the tree starts to change color in the fall earlier than the rest of the tree.

Acid rain levels have decreased because of new regulations, but not all the ecosystems are all recovering. The forests that have been affected by decades of acidity are much more sensitive because their natural buffers have been damaged (the calcium and magnesium in the soil have been leached out). This is because soils take thousands of years to develop so recovery is very, very slow. Despite the decrease in acid rain, the deciduous forests of New England may still experience a major die off.

Much has been done to decrease acid rain in the last few decades. In 1990, congress passed the **Clean Air Act** which requires companies to reduce their sulfur emissions. One way they do this is by installing “scrubbers” in their smokestacks. They release a liquid alkaline that mixes with the emissions and traps 80-95% of the sulfur pollutants before it can escape into the air.

Many scientists believe that the remaining levels of nitric oxides and sulfur oxides coming from smokestacks needs to be decreased further. Any decrease in carbon, sulfur and nitrogen emissions is helpful. Individuals can help. How?

- Driving less.
- Use electricity derived from wind or solar power.
- Spread the word about the importance of supporting acid rain reduction.

Acid Rain's Deadly Journey

Burning coal, oil and gasoline gives off sulfur, nitrogen and carbon into the air. This mixes with water vapor in the clouds making acid – sulfuric, nitric and carbonic acid.

Prevailing winds carry the acidic clouds thousands of kilometers before they release their acidic rain or snow.

