Chapter 12 Air

Section 3: Acid Precipitation

E.Q.: What is acid precipitation, what causes it, and how can we eliminate it?

Preview

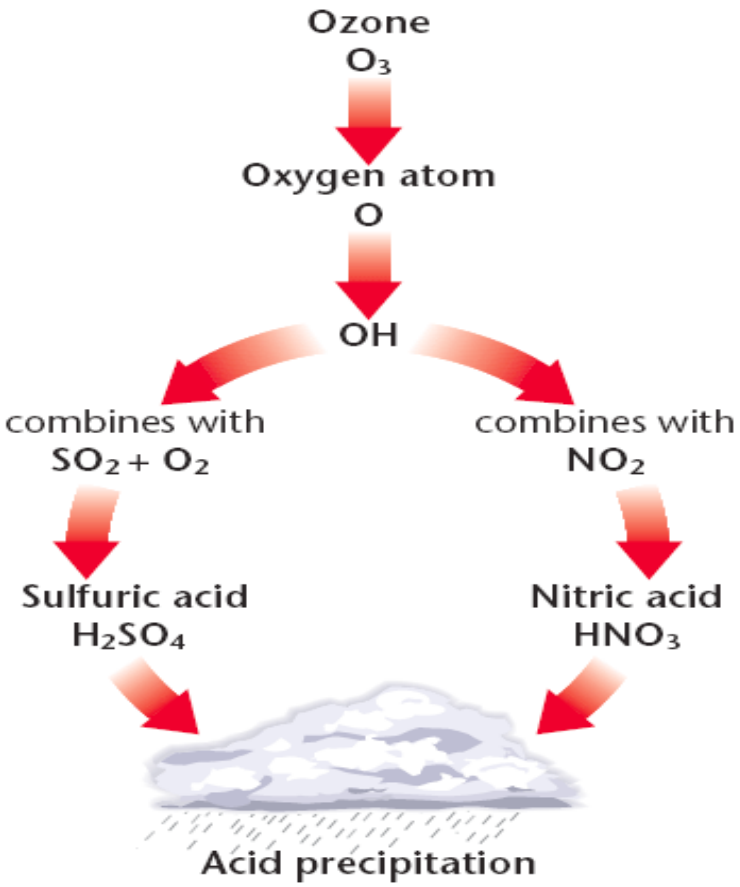
- **What Causes Acid Precipitation?**
- **How Acid Precipitation Affects Soils and Plants**
- **Acid Precipitation and Aquatic Ecosystems**
- **International Conflict**
- **International Cooperation**

Objectives

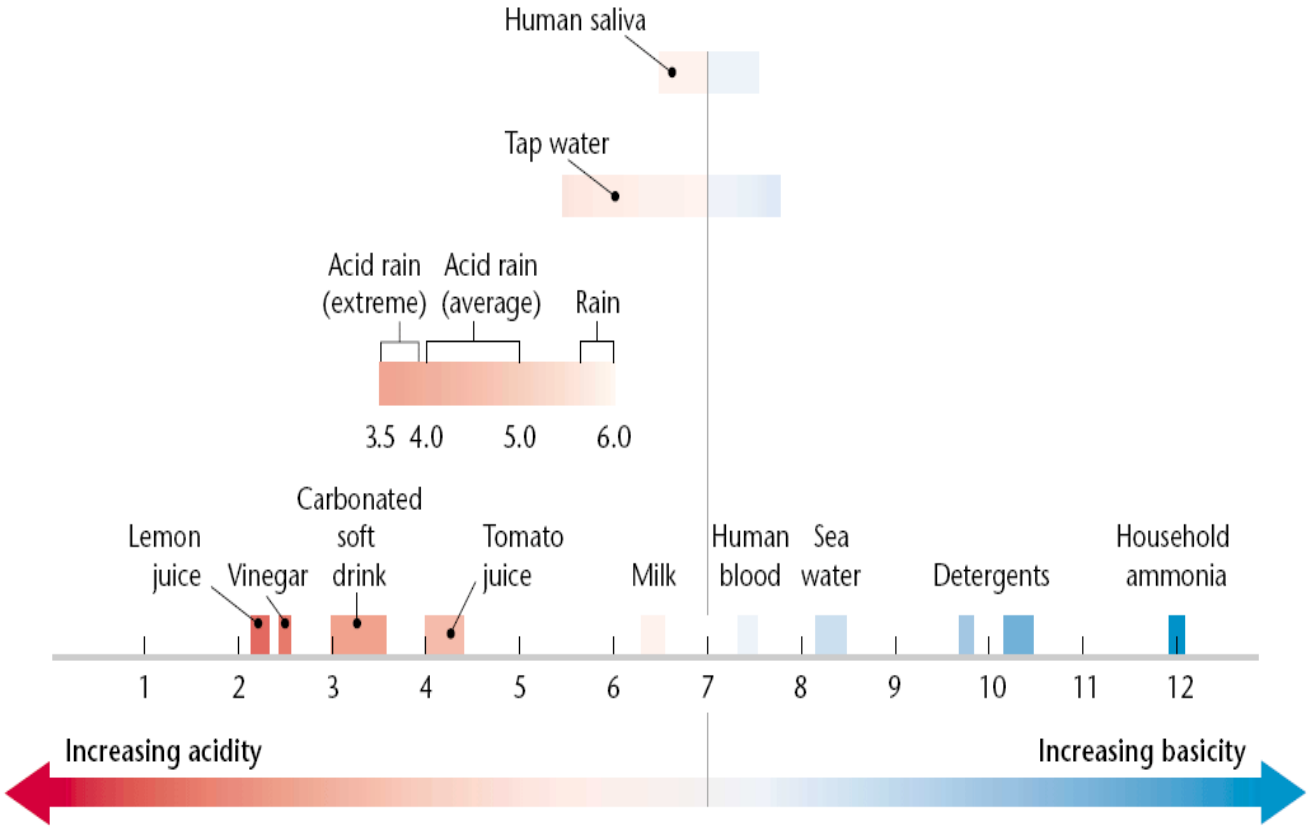
- **Explain the causes of acid precipitation.**
- **Explain how acid precipitation affects plants, soils, and aquatic ecosystems.**
- **Describe three ways that acid precipitation affects humans.**
- **Describe ways that countries are working together to solve the problem of acid precipitation.**

What Causes Acid Precipitation?

- **Acid precipitation is precipitation, such as rain, sleet, or snow, that contains a high concentration of acids, often because of the pollution of the atmosphere.**
- **When fossil fuels are burned, they release oxides of sulfur and nitrogen.**
- **When these oxides combine with water in the atmosphere they form sulfuric acid and nitric acid, which falls as acid precipitation.**



- **This acidic water flows over and through the ground, and into lakes, rivers, and streams.**
- **Acid precipitation can kill living things, and can result in the decline or loss of some local animal and plant populations.**
- **A pH number is a value that is used to express the acidity or alkalinity (basicity) of a system.**
- **Each whole number on the scale indicates a tenfold change in acidity.**
- **A pH of 7 is neutral, a pH of less than 7 is acidic, and a pH of greater than 7 is basic.**
- **Pure water has a pH of 7.0, while normal precipitation has a pH of about 5.6.**



- **Normal precipitation is slightly acidic because atmospheric carbon dioxide dissolves into the precipitation and forms carbonic acid.**
- **Precipitation is considered acid precipitation if it has a pH of less than 5.0**
- **The pH of precipitation varies among different geographic areas. The pH of precipitation in the eastern U.S. and Canada ranges from 4.2 to 4.8, with the most acidic precipitation occurring around Lake Erie and Lake Ontario.**

How Acid Precipitation Affects Soils and Plants

- **Acid precipitation can cause a drop in the pH of soil and water. This increase in the concentration of acid is called acidification.**
- **When the acidity of soil increases, some nutrients are dissolved and washed away by rainwater. It also causes aluminum and other**

toxic metals to be released and possibly absorbed by the roots of plants causing root damage.

- **Sulfur dioxide in water vapor clogs the openings on the surfaces of plants.**

<u>Acid Precipitation and Aquatic Ecosystems</u>

- **Aquatic animals are adapted to live in an environment with a particular pH range. If acid precipitation falls on a lake and changes the water's pH, it can kill aquatic plants and animals.**
- **In addition, acid precipitation causes aluminum to leach out of the soil surrounding a lake. The aluminum accumulates in the gills of fish and interferes with oxygen and salt exchange. As a result, fish are slowly suffocated.**
- **Acid shock is the sudden runoff of large amounts of highly acidic water into lakes and streams when snow melts in the spring or when heavy rains follow a drought.**
- **This phenomenon causes large numbers of fish to die, and affects the reproduction of fish and amphibians that remain. They produce fewer eggs, and those eggs often do not hatch. The offspring that do survive often have birth defects and cannot reproduce.**
- **To counteract the effects of acid precipitation on aquatic ecosystems, some states in the U.S. and some countries spray powdered limestone**

(calcium carbonate) on acidified lakes in the spring to help them restore their natural pH.

- **Because lime has a pH that is basic, the lime raises the pH of the water.**
- **Unfortunately, enough lime cannot be spread to offset all acid damage to lakes.**

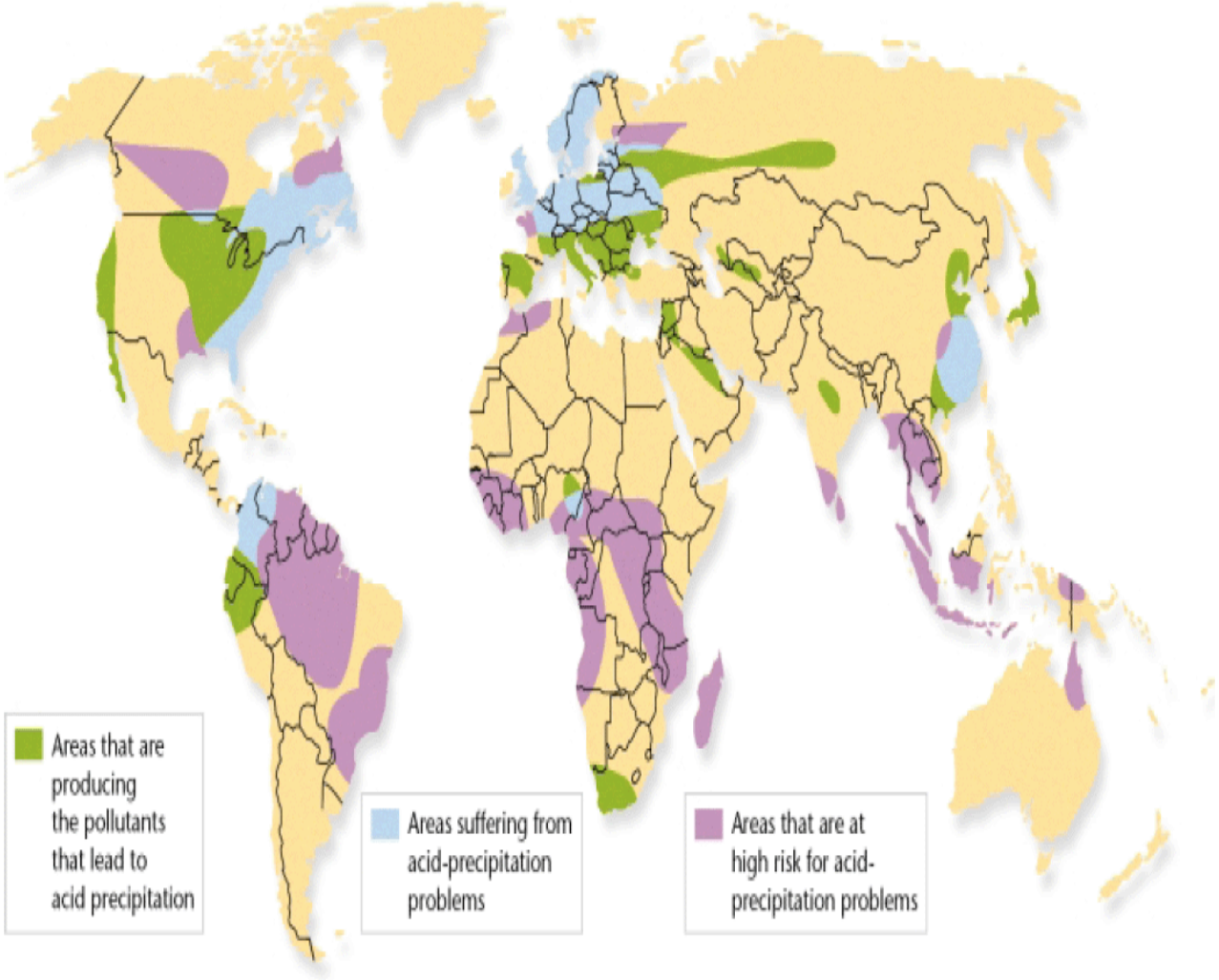
<u>Acid Precipitation and Humans</u>

- **Toxic metals such as aluminum and mercury can be released into the environment when soil acidity increases. These toxic metals can find their way into crops, water, and fish. The toxins then poison the human body.**
- **Research has also indicated that there may be a correlation between large amounts of acid precipitation received and an increase in respiratory problems in a community's children.**
- **The standard of living for some people is affected by acid precipitation. Decreases in numbers of fish caused by acidification of lakes can influence the livelihood of commercial fishermen and the sport-fishing industry. Forestry is also affected when trees are damaged by acid precipitation.**
- **Acid precipitation can dissolve the calcium carbonate in common building materials, such as concrete. As a result, some of the worlds most important and historic monuments, including those made of marble are being affected.**

International Conflict

- **One problem in controlling acid precipitation is that pollutants may be released in one geographical area and fall to the ground hundreds of kilometers away.**
- **For example, almost half of the acid precipitation that falls in southeastern Canada results from pollution produced in Ohio, Indiana, Pennsylvania, Illinois, Missouri, West Virginia, and Tennessee.**

International Conflict



International Cooperation

- **Because acid precipitation falls downwind, the problem of solving acid precipitation has been difficult, especially on the international level.**
- **Canada and the United States signed the Canada-U.S. Air Quality Agreement in 1991. Both countries agreed to reduce acidic emissions that flowed across the Canada-U.S. boundary.**
- **More international agreements such as this may be necessary to control the acid-precipitation problem.**