What is Acid Rain?

**Acid rain**, or **acid** deposition, is a broad term that includes any form of precipitation with **acidic** components, such as sulfuric or nitric acid that fall to the ground from the atmosphere in wet or dry forms. This can include **rain**, snow, fog, hail or even dust that is **acidic**.
Acid Rain

- Acid rain refers to rain (or any precipitation i.e. snow or fog) which is acidic in nature (has pH less than 5.6).
- It is generally a complex mixture of sulphuric acid ($H_2SO_4$) along with sulphurous acid ($H_2SO_3$) and nitric acid ($HNO_3$) along with nitrous acid ($HNO_2$).
WHAT IS ACID RAIN?

Acid Rain is the Precipitation that has a pH of less than that of natural rainwater (which is about 5.6 due to dissolved carbon dioxide)

It is formed when sulphur dioxides and nitrogen oxides, as gases or fine particles in the atmosphere, combine with water vapour and precipitate as sulphuric acid or nitric acid in rain, snow, or fog.
pH SCALE

Acidic

1 2 3 4 5

ACID RAIN

Normal Rain (5.6)
Pure Water (7.0)
Ocean Water

Basic

9 10 11 12 13

Liquid drain cleaner
Acid rain is an extremely destructive form of pollution, and the environment suffers from its effects. Forests, trees, lakes, animals, and plants suffer from acid rain.

**Trees**: The needles and leaves of the trees turn brown and fall off. Trees can also suffer from stunted growth; and have damaged bark and leaves, which makes them vulnerable to weather, disease, and insects. All of this happens partly because of direct contact between trees and acid rain, but it also happens when trees absorb soil that has come into contact with acid rain. The soil poisons the tree with toxic substances that the rain has deposited into it.
Health Problems

- Sulfur dioxide (SO2) and nitrogen oxides (NOx) gases turn into particles that can be inhaled deep into people’s lungs.
- In high levels of the fine particles there is an increase in illnesses, a key component of urban smog, cause inflammation and damage to tissues, and premature death from respiratory diseases such as:
  - Asthma and Bronchitis.
Health Problems

- These particles are particularly dangerous to the elderly and to people with heart and respiratory diseases.
- Nitrogen oxides cause ground-level ozone that causes respiratory problems like:
  - Pneumonia
  - Bronchitis
Effect on Soil

- Acid Rain also affects the soil by the soil neutralizing the acids.
- Soils that contain Limestone and Calcium Carbonate can neutralize the acids.
- Leaching - a process in which acid deposition adds hydrogen ions which displaces important nutrients like Calcium, Magnesium, and Potassium.
- Leaching pushes the ions deeper in the soil so the plants roots can’t reach them.
LAKES AND STREAMS

- an acidity of between 6 and 8.
- Acid rain can cause a pH of as low as 3 in some places.
- Cause to kill certain aquatic plant and animal life.
- Increase concentration of mercury, aluminium, manganese, lead and zinc in water.
- Norway and Sweden suffered most because no chalk and limestone (Geology)
Sulfur dioxide and oxides of nitrogen in acid rain damage the shine and texture of stone monuments and carvings.
How to Control Acid Rain?

1. Reduce amount of sulphur dioxide and oxides of nitrogen released into the atmosphere
   i. Use less energy (hence less fuel burnt)
   ii. Use cleaner fuels
   iii. Remove oxides of sulphur and oxides of nitrogen before releasing

2. Use cleaner fuels
   i. Coal that contains less sulphur
   ii. “Washing” the coal to reduce sulphur content
   iii. Natural Gas

3. Use other sources of electricity (i.e. nuclear power, hydro-electricity, wind energy, geothermal energy, and solar energy)
   i. Issue of cost

4. Reducing the effects of Acid Rain by Liming
   i. Powdered limestone/limewater added to water and soil to neutralize acid
   ii. Used extensively in Norway and Sweden
   iii. Expensive, short-term remedy