



Acid Rain

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Definition

Acid rain is a board term which describes the deposition of acids from the atmosphere on the earth.

It is a form of secondary air pollutant.

It takes place in two forms

- ▶ **Wet deposition** (flow of this acidic water through the ground affects a variety of plants and animals)
 - Refers to the **acid rain, fog** and **snow**.
- ▶ **Dry deposition**
 - Refers to **acidic gases** and **particles** in the atmosphere

What is pH?

A figure expressing the acidity or alkalinity of a solution on a logarithmic scale on which 7 is neutral, lower values are more acid and higher values more alkaline.

The pH is equal to $-\log_{10} c$, where c is the hydrogen ion concentration in moles per litre.

- ▶ Note: pH of pure water=7.0
- ▶ Normal Rainwater is slightly acidic (pH between 5.6-6.5 as it has weak carbonic acid formed by the combination of atmospheric CO₂ and H₂O.
The pH of acid rain is less than 5.6 and may be as low as 4.

Causes of Acid Rain

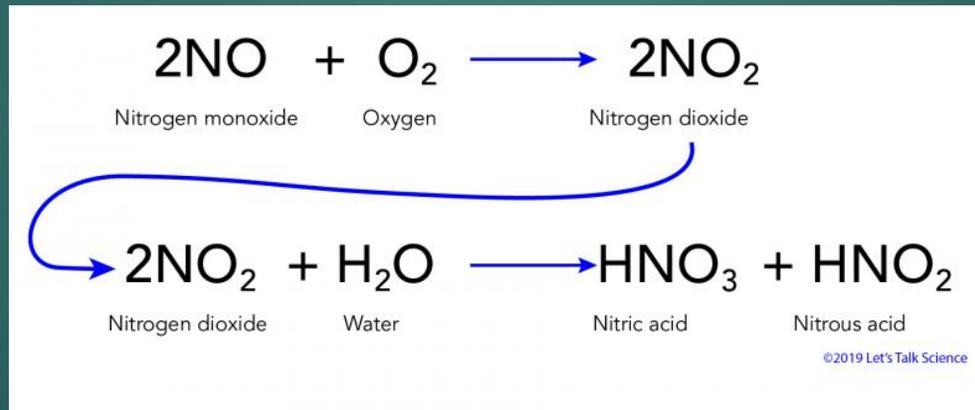
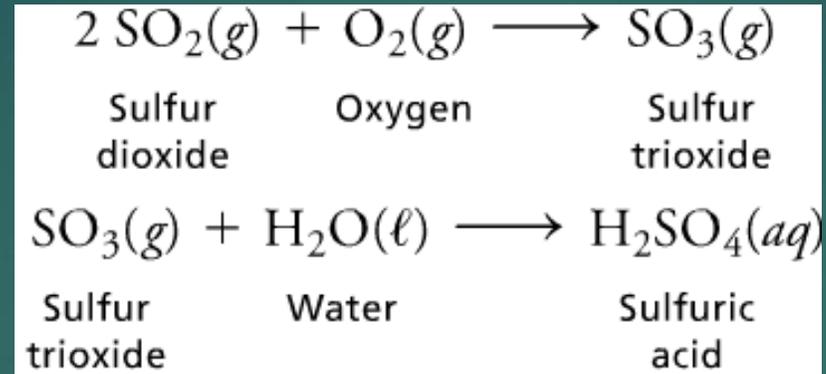
Primary cause of acid rain is the presence of excess of

- ▶ Sulphur dioxide (SO_2)
- ▶ Nitrogen oxides (NO_x)

The above gases are emitted by

1. Burning of fossil fuels
2. Various industries and smelters
3. Power plants
4. Automobile exhausts

Chemical reactions



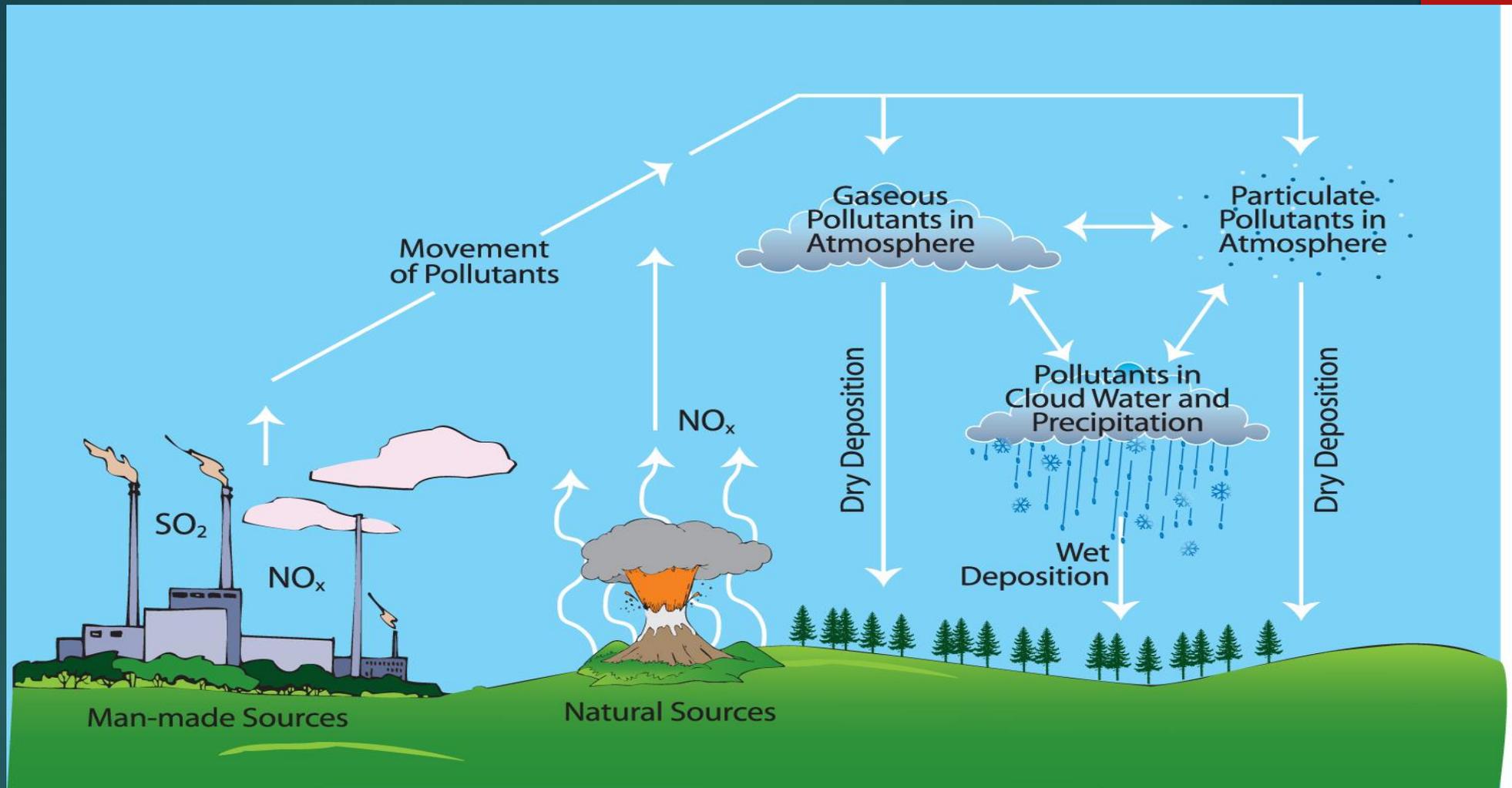


Fig : Diagram showing acid deposition on the earth

Effects of acid rain

- ▶ Accelerates the decay of building materials and paints, marble monuments including sculptures and statues that are part of national cultural heritage. e.g. Taj Mahal
- ▶ Acidification of lakes and streams which affects the aquatic ecosystem
- ▶ Toxicity to fish and planktons, snails, clams, insects and aquatic plants resulting in decline in their population
- ▶ Damage to trees at high elevations and many sensitive to forest soils
- ▶ Retards growth of terrestrial plants
- ▶ Increase in soil acidity and thus reduces soil fertility.
- ▶ Results in rusting or erosion of metals, particularly iron.
- ▶ Poses serious threat to human health as it contaminates not only the air but also the water and food.





Acid Rain Effects on Buildings



Nat. Geo. 160(5)665(1981)

Acid dissolves
limestone and marble

C. Ophardt, c. 2003

Measures to check/control acid rain

- ▶ Regular cleaning of smokestacks and exhaust pipes
- ▶ Switching to clean fuel, alternate fuel such as fuel cells, CNG etc. to power automobiles.
- ▶ Ban on burning of coal and petroleum
- ▶ Using quality coal which contains less sulphur
- ▶ Removal of SO₂ from the gases using devices called scrubbers
- ▶ Utilising renewable sources of energy such as nuclear power, wind, solar etc.
- ▶ Restoring the damaged environment such as limestones/lime to the acidic lakes or soil to neutralise its acidity

Case studies on acid rain

- ▶ Popularly known as the Taj Trapezium case. Taj Trapezium refers to an area of 10,400 sq. km. trapezium shaped area around Taj Mahal covering five districts in the region of Agra. Taj Mahal is one of the most popular and beautiful monuments of the world. Taj is one of the best examples of the Mughal architecture in India. It was declared as a UNESCO World Heritage Site in 1983. In 1984, M.C. Mehta, a public interest lawyer visited Taj Mahal. *He saw that the monument's marble had turned yellow and was pitted as a result of pollutants from nearby industries. This compelled Mehta to file this petition before the Supreme Court*

- ▶ <http://lawtimesjournal.in/case-case-summary/>



[aj-trapezium-](#)

THANK YOU