Environmental Science

Unit –II Air and sound Pollution

Part-I Air Pollution

(Air pollutants, classification, (Primary & secondary Pollutants) Adverse effects of pollutants. Causes of Air pollution chemical, photochemical, Greenhouse effect, ozone layer depletion, acid Rain, carbon sequestration, cloud seeding
)

By

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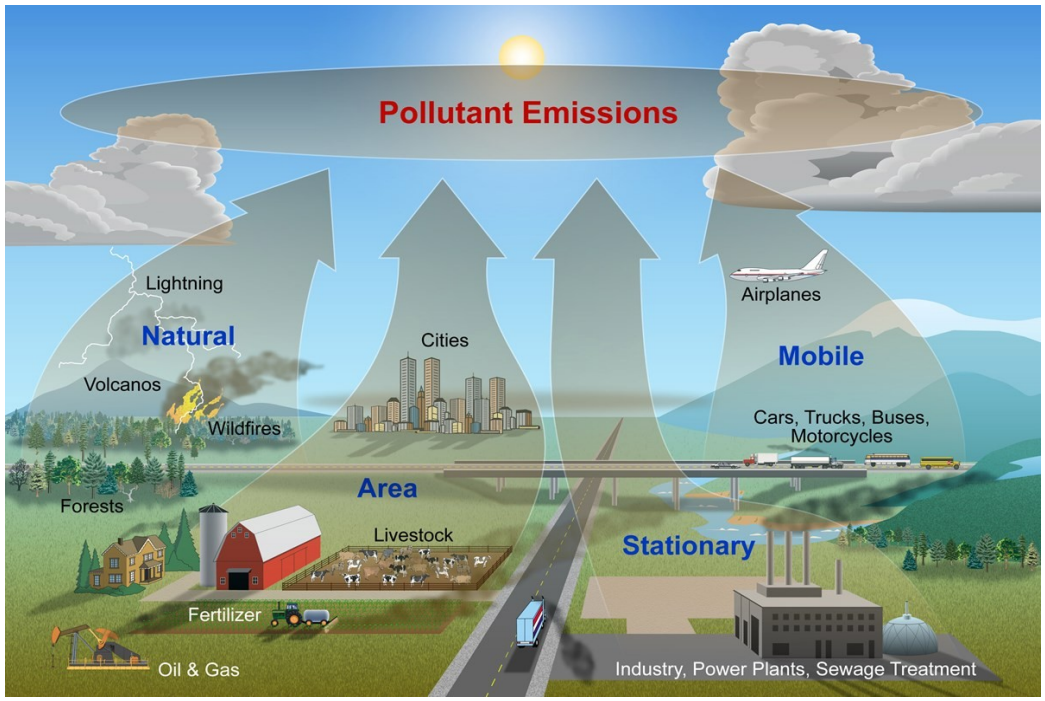
Air Pollution

- Air pollution is the presence of undesirable solid or gaseous particles in the air in quantities that are harmful to human health and environment.



Pollutants

- **Primary Pollutants**

There are five primary pollutants that contribute to 90% of global air pollution. These are carbon oxides (CO & CO_2), N oxides, sulphur oxides, volatile organic compounds, and suspended particulate matter.

- **Secondary Pollutants**

The pollutants that are produced in the atmosphere, when certain chemical reactions take place among the primary pollutants and with others in the atmosphere are called secondary air pollutants.

Eg: Sulphuric acid nitric acid, carbonic acid and acid rain, paticulates.

Note:- Particulates are small pieces of solid material.

Cause of Air pollution

Air pollution may originate from one or more variety of sources.

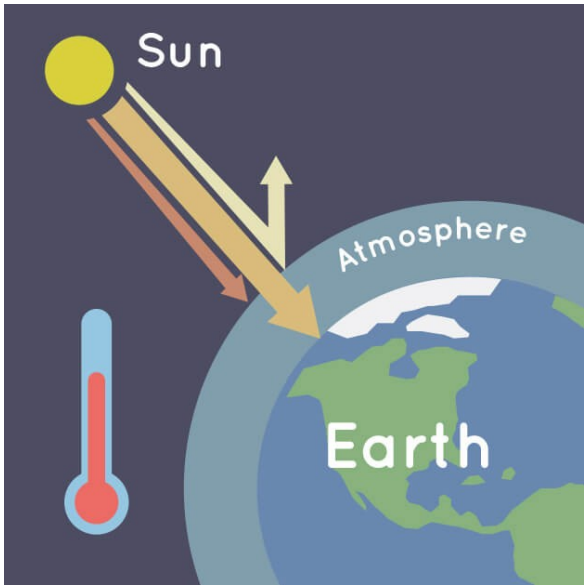
- The **natural pollution** includes sources such as oceanic aerosol, volcanic emissions, biogenic sources, windblown terrestrial dust and lightening.
- The **artificial pollution** generates from human activities and includes sources such as fuel burning, refuge burning, transportation, construction of buildings, chemical factories, metallurgical factories and, vehicles.
- The **third category** includes solvent usage and sources include spray painting and solvent extraction. Automobiles are the first-rate of polluters. Industries occupy second position.

Effects of Air pollution

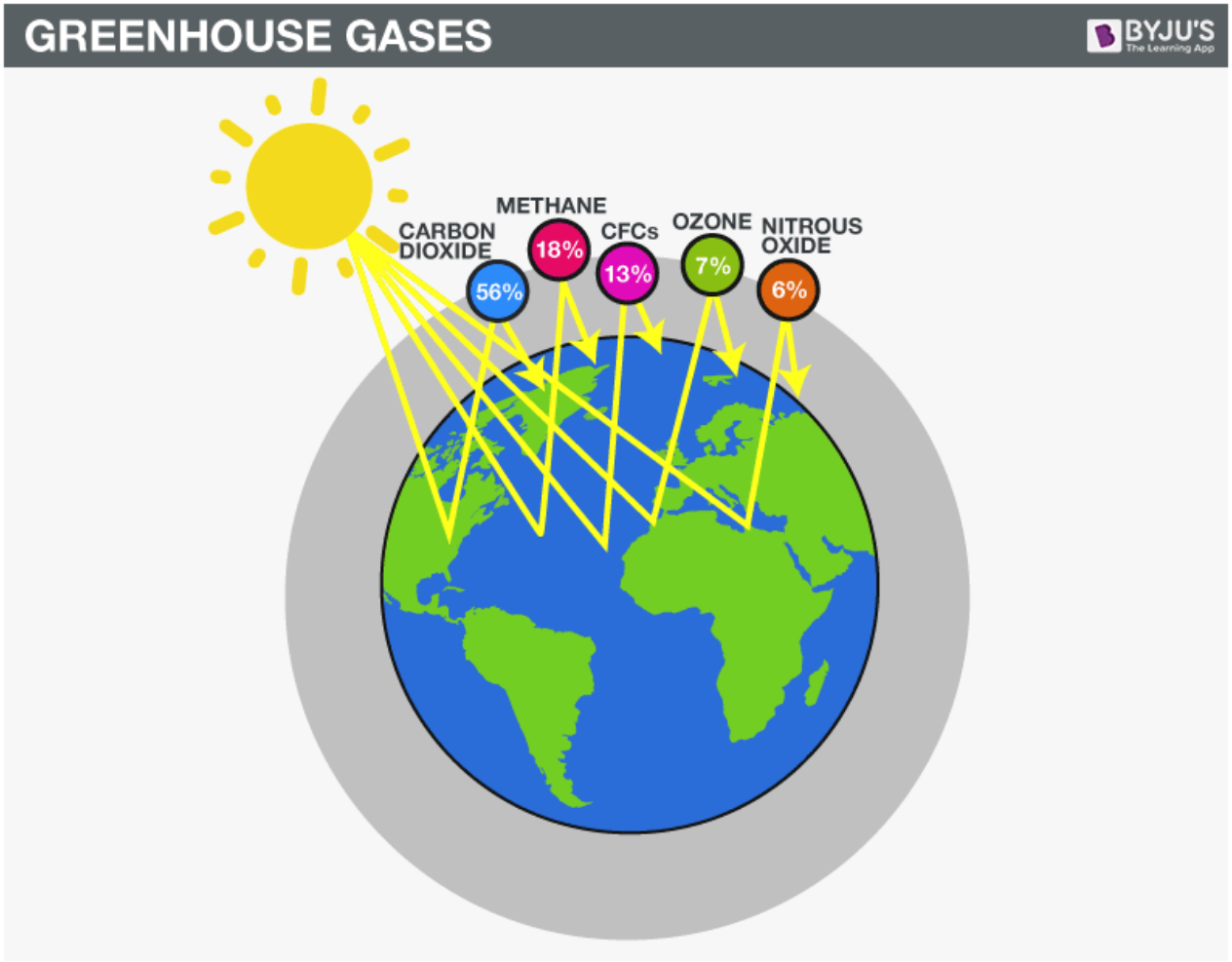
- **On human health**: Particulates cause carcinogenic effects, accumulate in lungs and interfere with ability of lungs to exchange gases. Prolonged exposure causes lung cancer and asthma.
- **On plants**: Gaseous pollutants enter the leaf pores and damage the leaves of crop plants, interfere with photosynthesis and plants growth and reduces nutrient uptake and causes the leaves to turn yellow, brown or drop off altogether.
- **On materials**: Air pollutants break down the exterior paint on cars and houses.
- **On stratosphere**: The upper stratosphere consists of considerable amounts of ozone, which works as an effective screen for UV light. Presence of certain pollutants can accelerate the breakdown of ozone. Depletion of ozone effects human health, food productivity and climate

Green House effect

- The greenhouse effect is the way in which heat is trapped close to Earth's surface by “greenhouse gases.”
- During the day the sun heats up the earth’s atmosphere. At night, when the earth cools down the heat is radiated back into the atmosphere. During this process, the heat is absorbed by the greenhouse gases in the earth’s atmosphere. This is what makes the surface of the earth warmer, that makes the survival of living beings on earth possible.



Green house gases



Causes of Greenhouse effect

- Burning of Fossil Fuels

Fossil fuels are an important part of our lives. They are widely used in transportation and to produce electricity. Burning of fossil fuels releases carbon dioxide. With the increase in population, the utilization of fossil fuels has increased. This has led to an increase in the release of greenhouse gases in the atmosphere.

- Deforestation

Plants and trees take in carbon dioxide and release oxygen. Due to the cutting of trees, there is a considerable increase in the greenhouse gases which increases the earth's temperature.

Causes of Greenhouse effect

- Farming

Nitrous oxide used in fertilizers is one of the contributors to the greenhouse effect in the atmosphere.

- Industrial Waste and Landfills

The industries and factories produce harmful gases which are released in the atmosphere.

Landfills also release carbon dioxide and methane that adds to the greenhouse gases.

Effects of Greenhouse Effect

- Global Warming

It is the phenomenon of a gradual increase in the average temperature of the Earth's atmosphere.

Cause: The increased volumes of greenhouse gases

Depletion of Ozone Layer

Ozone Layer protects the earth from harmful ultraviolet rays from the sun. It is found in the upper regions of the stratosphere. The depletion of the ozone layer results in the entry of the harmful UV rays to the earth's surface.

Cause: Accumulation of natural greenhouse gases including chlorofluorocarbons, carbon dioxide, methane, etc.

Effects of Greenhouse Effect

- Smog and Air Pollution

Smog is formed by the combination of smoke and fog.

Smog is generally formed by the accumulation of more greenhouse gases including nitrogen and sulfur oxides. The major contributors to the formation of smog are automobile and industrial emissions, agricultural fires, natural forest fires and the reaction of these chemicals among themselves.

- Acidification of Water Bodies

Increase in the total amount of greenhouse gases in the air has turned most of the world's water bodies acidic. The greenhouse gases mix with the rainwater and fall as acid rain. This leads to the acidification of water bodies.

Ozone Layer Depletion

Cause of ozone depletion

- Manufactured chemicals, especially halocarbon refrigerants, solvents, propellants, and foam- blowing agents (chlorofluorocarbons (CFCs), HCFCs, halons).

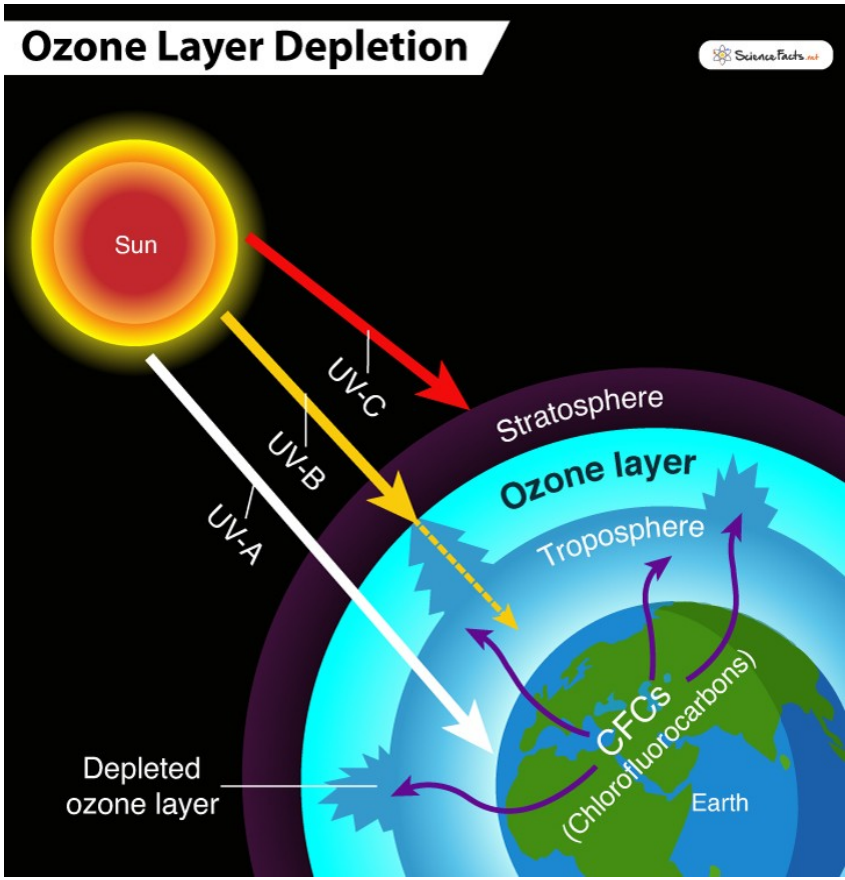
Effects

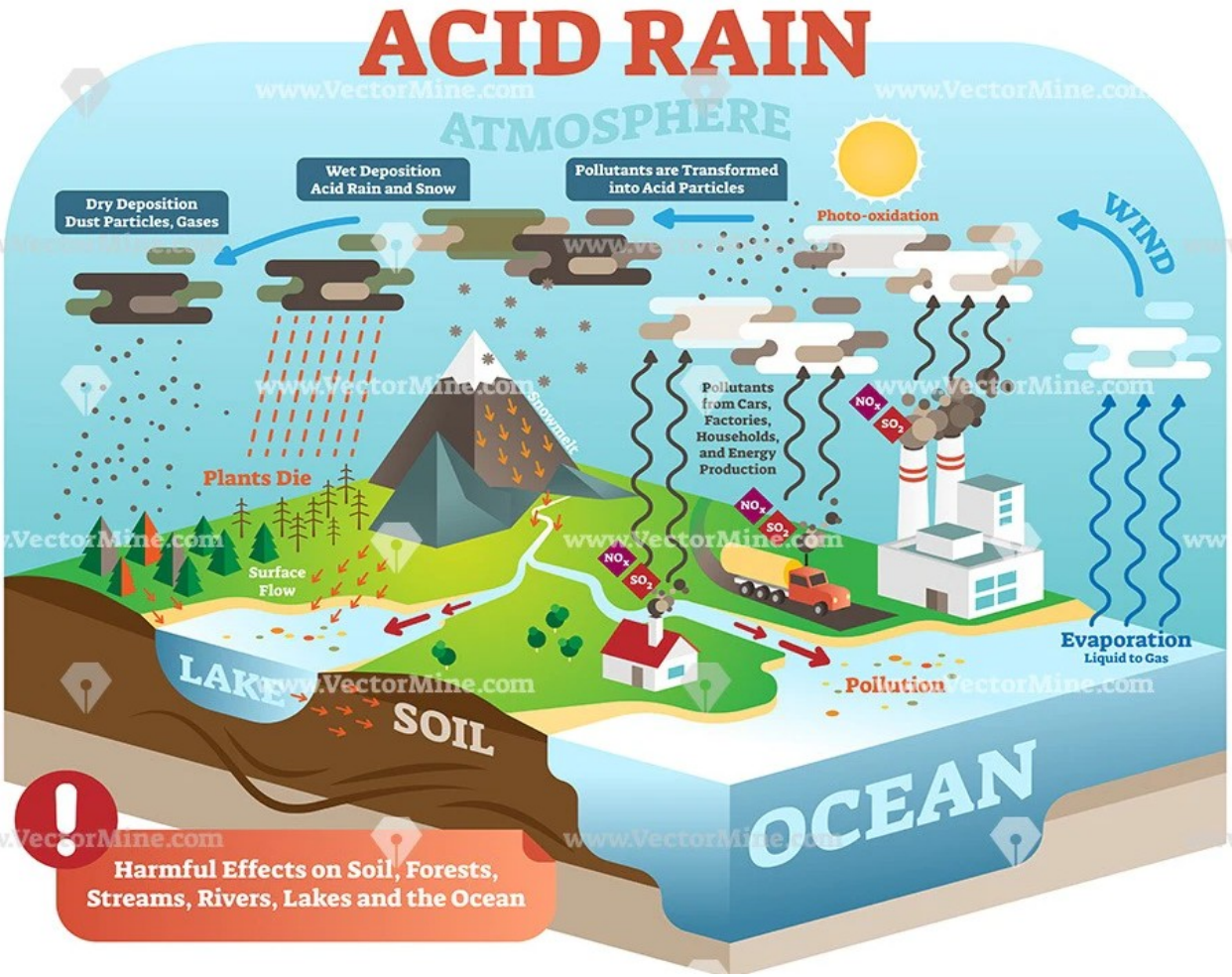
- The depletion of the ozone layer has harmful effects on the human health, animals, environment and marine life.
- Increase in UV-B rays is the main causes of skin cancer
- plays a major role in malignant melanoma development
- Create sunburns, quick ageing, eye cataracts, blindness, weekend immune system e.t.c.

Ozone Layer Depletion

Effect on animals, plants and Marine life

- Direct exposure to ultraviolet radiations also leads to skin and eye cancer in animals.
  UV-B rays negatively affect plants, crops, lead to minimal plant growth, smaller leaf size, flowering and photosynthesis in plants, lower quality crops for humans.
- Planktons and zooplankton are greatly affected by the exposure to UV-B rays. If the planktons declines, it would affect all the marine life in the lower food chain.





- 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.

Causes of Acid Rain

- Acid rain results when sulfur dioxide (SO_2) and nitrogen oxides (NO_X) are emitted into the atmosphere and transported by wind and air currents. The SO_2 and NO_X react with water, oxygen and other chemicals to form sulfuric and nitric acids. These then mix with water and other materials before falling to the ground.
- The major sources of SO_2 and NO_X in the atmosphere are:
- Burning of fossil fuels to generate electricity. Two-thirds of SO_2 and one-fourth of NO_X in the atmosphere come from electric power generators.
- Vehicles and heavy equipment.
- Manufacturing, oil refineries, and other industries.

Carbon Sequestration

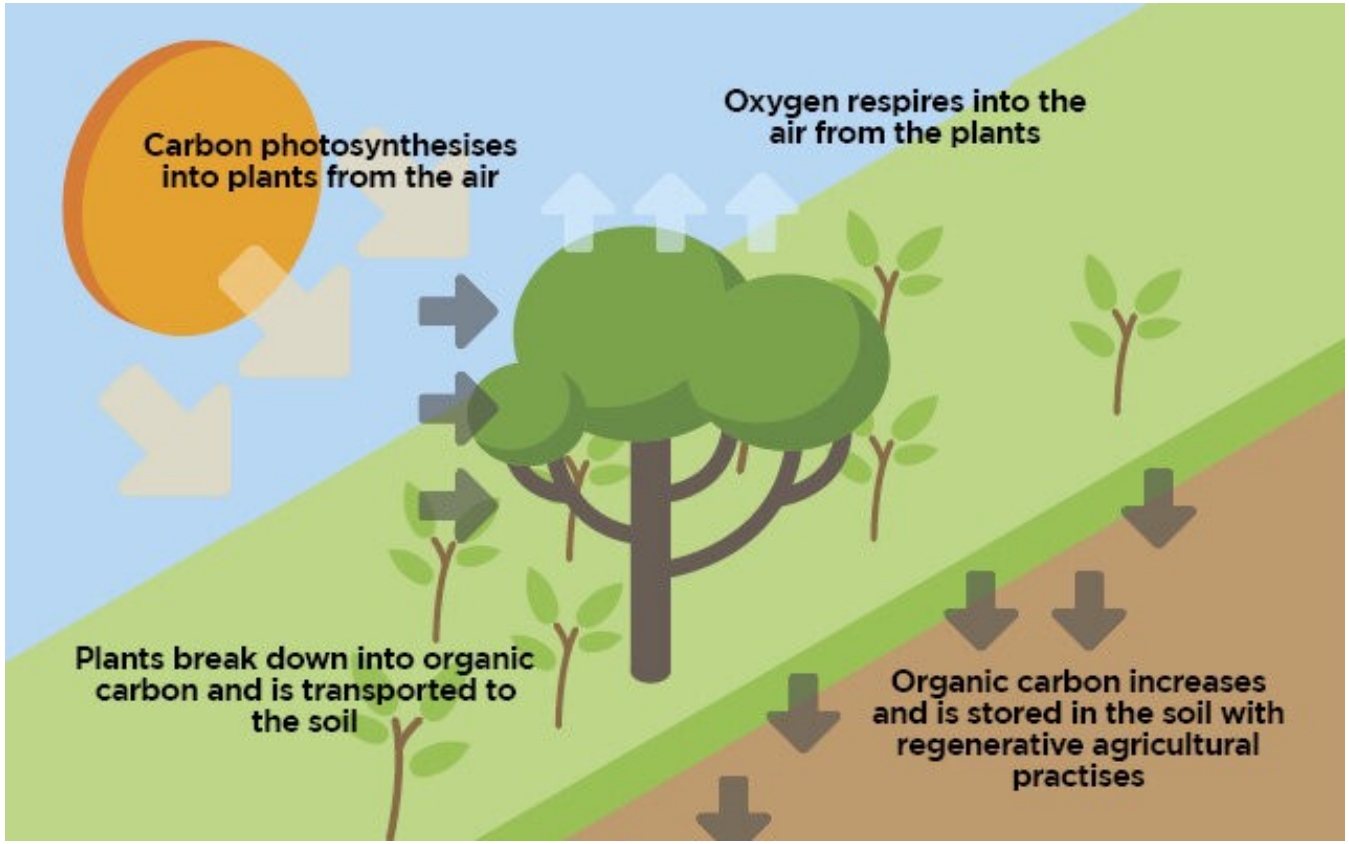
- Carbon dioxide is the most commonly produced greenhouse gas. Carbon sequestration is the process of **capturing and storing atmospheric carbon dioxide**. It is one method of reducing the amount of carbon dioxide in the atmosphere with the goal of reducing global climate change.

- Two major types of carbon sequestration are: geologic and biologic.
  - **Geologic carbon sequestration**
  - **Biologic carbon sequestration**

Geologic Carbon Sequestration

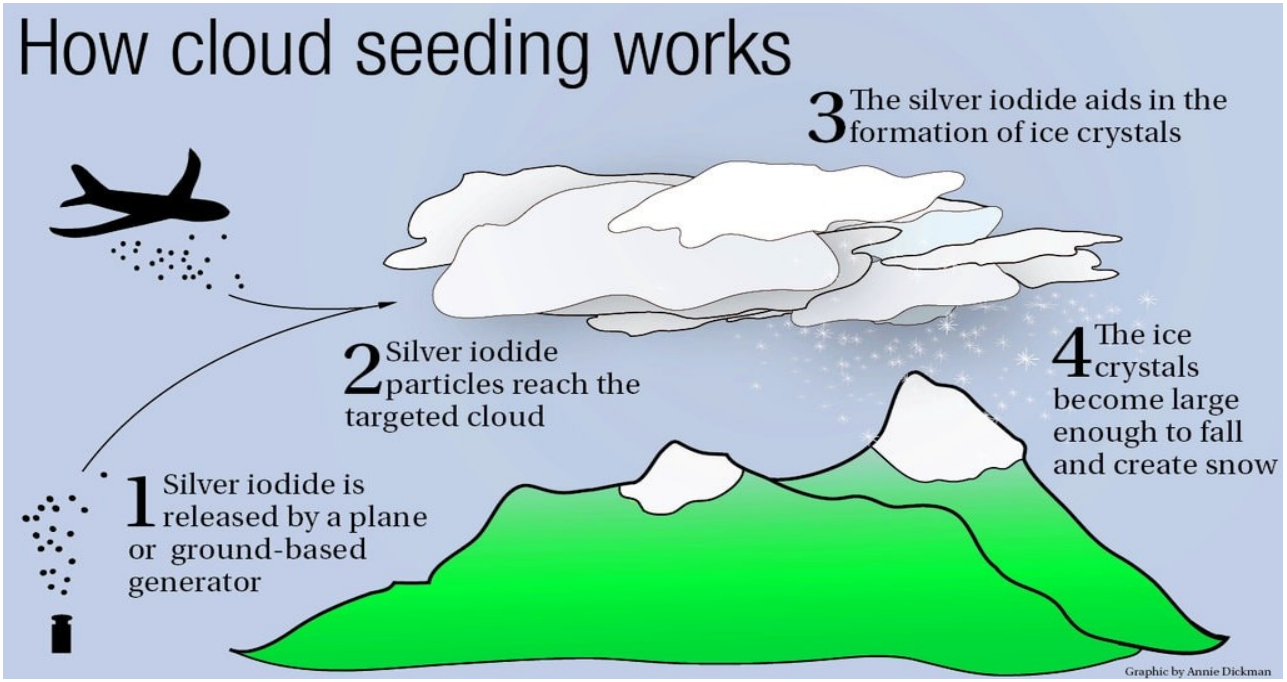
The process of storing carbon dioxide (CO_2) in underground geologic formations. The CO_2 is usually pressurized until it becomes a liquid, and then it is injected into porous rock formations in geologic basins.

Biologic Carbon Sequestration



It refers to the storage of atmospheric carbon in vegetation, soils, woody products, and aquatic environments. For example, by encouraging the growth of plants—particularly larger plants like trees—advocates of biologic sequestration hope to help remove CO_2 from the atmosphere.

Cloud Seeding



- **Cloud seeding** is a type of weather modification that aims to change the amount or type of precipitation that falls from clouds by dispersing substances into the air that serve as cloud condensation or ice nuclei, which alter the microphysical processes within the cloud.

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Part-II Sound Pollution
(Causes, controlling measures, measurement of sound pollution, Industrial and non-industrial)

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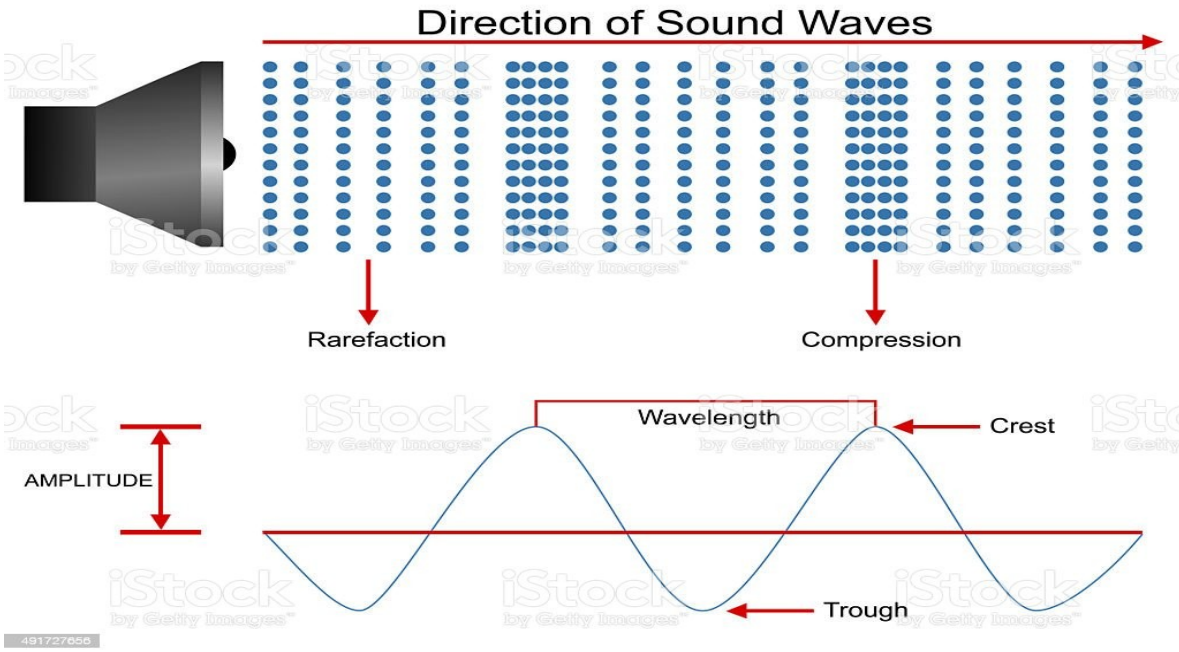
Sound Pollution

- Sound is a type of mechanical wave which moves by oscillating the particles of the medium in which it is travelling.
- Sound can propagate through air, liquid or solid.
- Sound is pressure perturbation in the medium through which it travels. Sound pressure creates alternate compression and rarefaction. The number of c and r per unit time is called frequency.

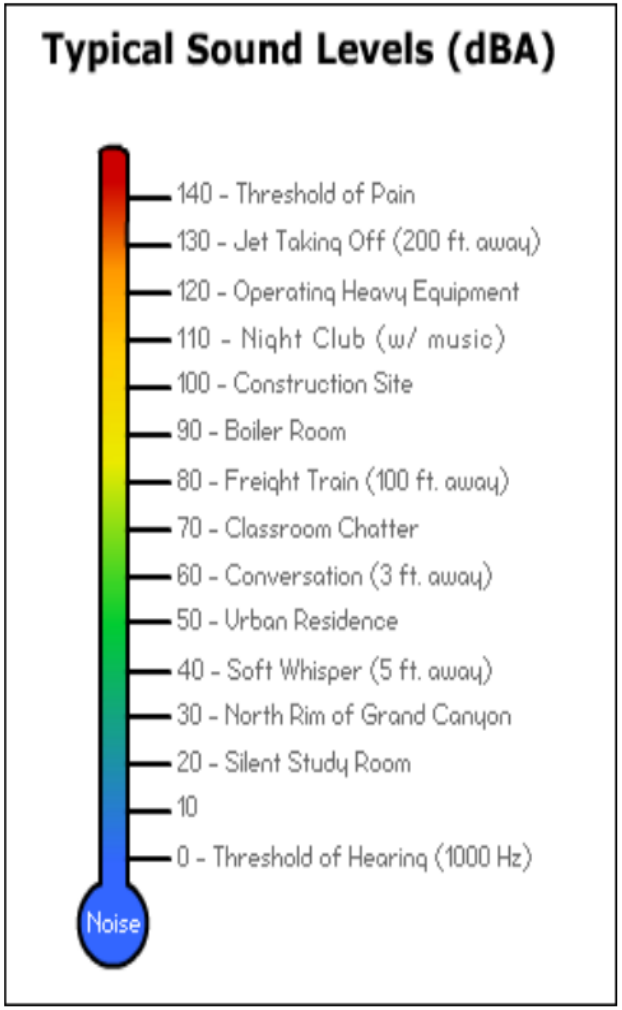


Measurement of Sound Pollution

- Noise is measured in terms of **sound pressure level** (SPL).
- Sound pressure level (SPL) is the pressure level of a sound, measured in decibels (dB).

$$SPL = 20 \log_{10}(P_{rms} / P_{ref})$$

- It is equal to 20 x Log_{10} of the ratio of the actual Root Mean Square (RMS) of sound pressure to the reference of sound pressure
- The reference sound pressure in air is 2 x 10^{-5} N/m^2, or 20µPa). And for other materials, it reduces to 1µPa
- A decibel is the standard for the measurement of noise. The zero on a decibel scale is at the threshold of hearing, the lowest sound pressure that can be heard, on the scale, acc. To smith,
  - ✓ 20 db is whisper
  - ✓ 40 db the noise in a quiet office
  - ✓ 60 db is normal conversation
  - ✓ 80 db is the level at which sound becomes physically painful.



Sources of noise pollution

Industrial Activities

Construction Sites

household

transportation

Social Events

Sources of Noise Pollution

- **Road Traffic Noise:** In the city, the main sources of traffic noise are the motors and exhaust systems of autos , smaller trucks, buses, and motorcycles.

- **Air Craft Noise:** Now-a-days, the problem of low-flying military aircraft has added a new dimension to community annoyance, as the nation seeks to improve its nap-of-the-earth aircraft operations over national parks, wilderness areas, and other areas previously unaffected by aircraft noise has claimed national attention over recent years.

- **Noise from railroads:** The noise from locomotive engines, horns and whistles, and switching and shunting operations in rail yards can impact neighboring communities and railroad workers.

  Example: Rail car retarders can produce a high frequency, high-level screech that can reach peak levels of 120 dB at a distance of 100 feet, which translates to levels as high as 138, or 140 dB at the railroad worker's ear.

Sources of Noise Pollution

❖**Construction Noise:**

The noise from the construction of highways, city streets, and buildings is a major contributor to the urban scene. Construction noise sources include pneumatic hammers, air compressors, bulldozers, loaders, dump trucks (and their backup signals), and pavement breakers.

❖**Noise from Consumer products:**

Certain household equipment, such as vacuum cleaners and some kitchen appliances have been and continue to be noisemakers, although their contribution to the daily noise dose is usually not very large.

Effects of Noise Pollution

The effects of noise pollution on Human beings, Animals and property are as follows:

- **Decreases the efficiency of a man**:- Regarding the impact of noise on human efficiency, there is a number of experiments that print out the fact that human efficiency increases with noise reduction.

- **Lack of concentration**:- For better quality of work there should be concentration, Noise causes a lack of concentration. In big cities, mostly all the offices are on the main road. The noise of traffic or the loudspeakers of different types of horns diverts the attention of the people working in offices.

- **Fatigue**:- Because of Noise Pollution, people cannot concentrate on their work. Thus they have to give more time to complete the work and they feel tired.

- **It causes Blood Pressure**: - Noise Pollution causes certain diseases in humans. It attacks on the person's peace of mind. The noises are recognized as major contributing factors in accelerating the already existing tensions of modern living. These tensions result in certain diseases like blood pressure or mental illness etc.

Control of Noise Pollution

- **Reduction in the source** of noise
- Noise-making machines should be kept in containers with **sound-absorbing media**
- **Proper oiling** will reduce noise from machinery
- **Using silencers** – fibrous material
- **Planting trees**
- **Legislation** can prevent excess sound production, unnecessary horn blowing etc.

Other Measure of Controlling Noise Pollution

Directive Principles of State Policy:

The state has the object to make the environment pollution free.

- **Fundamental Duties**

Every citizen of the country has the fundamental duty to clean the environment.

- **CRPC. Section 133**

Conditional order to remove the nuisance

- **I.P.C. Public Nuisance law 268-295**
- **Section 268** talks about public nuisance causing noise pollution also comes under the provisions of Section 268.
- **Section 287** talks about the irresponsible use of any machinery.
- **Section 288** talks about the construction of buildings
- **Section 290** talks about the noise-related incident causing some form of a public nuisance.
- **Section 291** deals with the repetition of nuisance
- **Section 294** talks about indecent songs