

Environment

The word Environment is derived from the French word “Environ” which means “surrounding”. Our surrounding includes biotic factors like human beings, Plants, animals, microbes, etc and abiotic factors such as light, air, water, soil, etc.

Our environment has been classified into four major components:

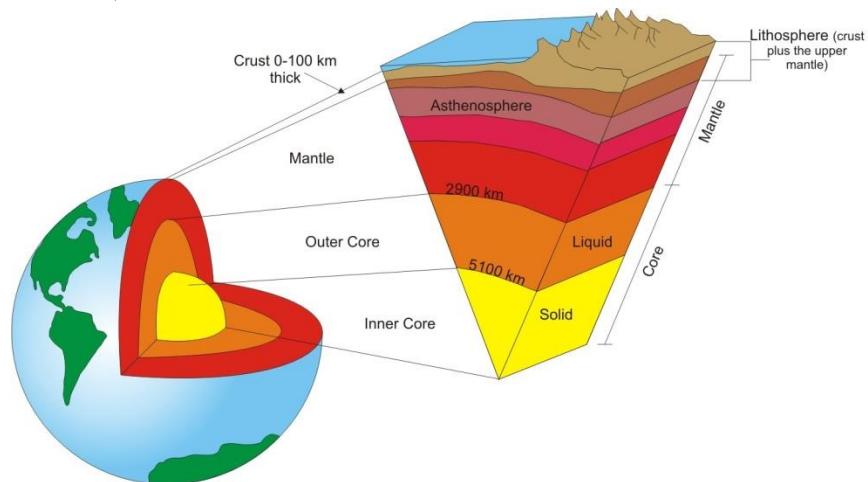
1. Hydrosphere, 2.Lithosphere, 3.Atmosphere, 4.Biosphere.

1. **Hydrosphere:** Major part of earth's surface is covered with water. About 75% of earth's surface. Therefore earth is called as water planet or blue planet. Water exists in solid, liquid and gas state.

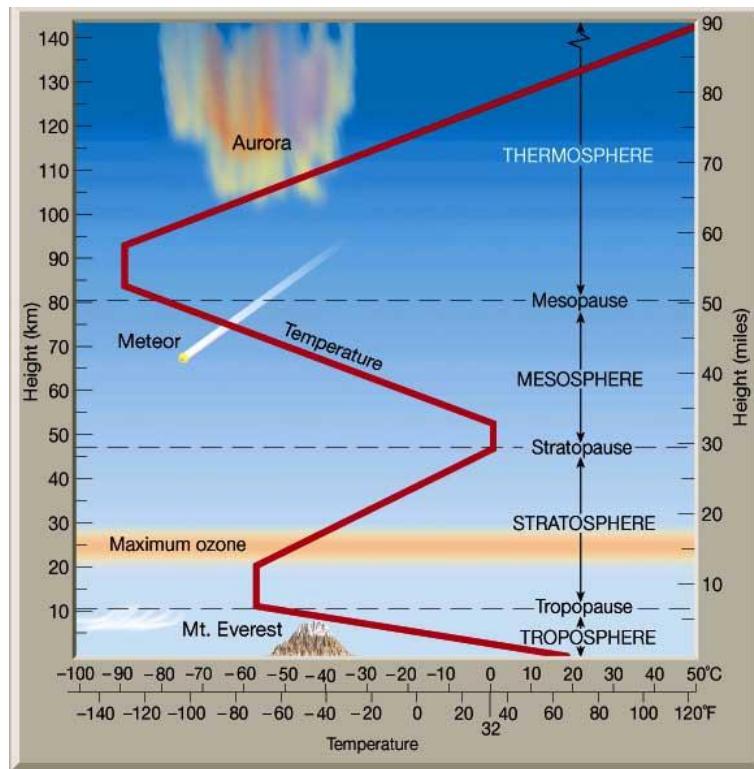
Sr. No.	Distribution	Percentage
1	Ocean, Sea	97.1
2	Frozen Ice	2.15
3	Ground water	0.65
4	Surface water	0.03

We observe water is present in solid form in Glaciers, ice cubes and snow. In liquid form in river, sea and ocean, and in gaseous state as evaporation. All the water present on the surface and below the ground comes under hydrosphere. Hydrosphere includes all water bodies such as lakes, ponds, rivers, streams and ocean etc. Hydrosphere functions in a cyclic nature, which is termed as hydrological cycle or water cycle.

2. **Lithosphere:** Lithosphere means the mantle of rocks constituting the earth's crust. The earth is a cold spherical solid planet of the solar system, which spins in its axis and revolves around the sun at a certain constant distance. Lithosphere mainly, contains soil, earth rocks, mountain etc. Lithosphere is divided into three layers-crusts, mantle and core (outer and inner).



3. Atmosphere: The cover of the air that envelopes the earth is known as the atmosphere. It includes Ne, He, CH₄, O₃, N₂, O₂, CO₂ and water vapors. Most valuable gases O₂ and CO₂ which is provided by atmosphere. Oxygen is essential for life and carbon dioxide is essential for photosynthesis. Atmosphere forms a protective cover over the earth, it protects earth from excessive radiation and it balances the heat on the earth. There are five concentric layers within the atmosphere, which can be differentiated on the basis of temperature and each layer has its own characteristics. These include the troposphere, the stratosphere, the mesosphere, the thermosphere.



- Troposphere: troposphere is that we live in near the surface of earth. Lowest layer of atmosphere. The temperature is decreased with height. The boundary between stratosphere and troposphere is called as tropopause.
- Stratosphere: above the tropopause lies the stratosphere. In this layer temperature is increased with height. Ozone is present in this layer and it is warm because it absorbed UV rays.
- Mesosphere: the layer above the stratopause. The temperature is decreased with height.

- Thermosphere: Uppermost layer of atmosphere. Temperature increases with height because it is directly heated by sun.
4. Biosphere: It is otherwise known as the life layer, it refers to all organisms on the earth's surface and their interaction with water and air. It consists of plants, animals and micro-organisms, ranging from the tiniest microscopic organism to the largest whales in the sea. Biology is concerned with how millions of species of animals, plants and other organisms grow, feed, move, reproduce and evolve over long periods of time in different environments. Its subject matter is useful to other sciences and professions that deal with life, such as agriculture, forestry and medicine. The richness of biosphere depends upon a number of factors like rainfall, temperature, geographical reference etc. Apart from the physical environmental factors, the man made environment includes human groups, the material infrastructures built by man, the production relationships and institutional systems that he has devised. The social environment shows the way in which human societies have organized themselves and how they function in order to satisfy their needs.

Environmental Issues

- **Acid rain:** Acid rain is a rain or other form of precipitation that is unusually acidic or acid rain includes various ways of acid fall from the atmosphere. Acid rain is also called as acid deposition, which is of two forms wet and dry. The wet deposition is acidic rain, fog and snow. The dry deposition means 'spread of acidic gases and particles'.

Causes of acid rain:

Natural Sources: The major natural causal agent for acid rain is volcanic emissions. Volcanoes emit acid producing gases to create higher than normal amounts of acid rain or any other form of precipitation such as fog and snow to an extent of affecting vegetation cover and health of residents within the surrounding. Decaying vegetation, wildfires and biological processes within the environment also generate the acid rain forming gases. Dimethyl sulfide is a typical example of a major biological contributor to sulfur containing elements into the atmosphere. Lightning strikes also naturally produces nitric oxides that react with water molecules via electrical activity to produce nitric acid, thereby forming acid rain.

Manmade sources: Human activities leading to chemical gas emissions such as sulfur and nitrogen are the primary contributors to acid rain. The activities include air pollution sources emitting sulfur and nitrogen gases like factories, power generation facilities, and automobiles. In particular, use of coal for electrical power generation is the biggest contributor to gaseous emissions leading to acid rain. Automobiles and factories also release high scores of gaseous emissions on daily basis into the air, especially in highly industrialized areas and urban regions with large numbers of car traffic. These gases react in the atmosphere with water, oxygen, and other chemicals to form various acidic

compounds such as sulfuric acid, ammonium nitrate, and nitric acid. As a result, these areas experience exceedingly high amounts of acid rain.

Effects of acid rain:

- **Effect on Aquatic Environment:** Acid rain either falls directly on aquatic bodies or gets run off the forests, roads and fields to flow into streams, rivers and lakes. Over a period of time, acids get accumulated in the water and lower the overall pH of the water body. The aquatic plants and animals need a particular pH level of about 4.8 to survive. If the pH level falls below that the conditions become hostile for the survival of aquatic life. At pH levels below 5, most fish eggs cannot hatch. Lower pH can also kill adult fish. Acid rain runoff from catchment areas into rivers and lakes has also reduced biodiversity as rivers and lakes become more acidic. Species including fish, plant and insect types in some lakes, rivers and brooks have been reduced and some even completely eliminated owing to excess acid rain flowing into the waters.
- **Effect on Forests:** It makes trees vulnerable to disease, extreme weather, and insects by destroying their leaves, damaging the bark and arresting their growth.
- **Effect on Soil:** Acid rain highly impacts on soil chemistry and biology. It means, soil microbes and biological activity as well as soil chemical compositions such as soil pH are damaged or reversed due to the effects of acid rain. The soil needs to maintain an optimum pH level for the continuity of biological activity. When acid rains seep into the soil, it means higher soil pH, which damages or reverses soil biological and chemical activities. Hence, sensitive soil microorganisms that cannot adapt to changes in pH are killed.
- **Vegetation Cover and Plantations:** The damaging effects of acid rain on soil and high levels of dry depositions have endlessly damaged high altitude forests and vegetation cover since they are mostly encircled by acidic fogs and clouds. Besides, the widespread effects of acid rain on ecological harmony have lead to stunted growth and even death of some forests and vegetation cover.
- **Effect on Architecture and Buildings:** Acid rain on buildings, especially those constructed with limestone, react with the minerals and corrode them away. This leaves the building weak and susceptible to decay. Modern buildings, cars, airplanes, steel bridges and pipes are all affected by acid rain. Irreplaceable damage can be caused to the old heritage buildings.
- **Effect on Public Health:** When in atmosphere, sulfur dioxide and nitrogen oxide gases and their particulate matter derivatives like sulfates and nitrates, degrades visibility and can cause accidents, leading to injuries and deaths. Human health is not directly affected by acid rain because acid rain water is too dilute to cause serious health problems. However, the dry depositions also known as gaseous particulates in the air which in this case are nitrogen oxides and sulfur dioxide can cause serious health problems when

inhaled. Intensified levels of acid depositions in dry form in the air can cause lung and heart problems such as bronchitis and asthma.

Ozone Layer Depletion: About 15-30 km from ground in a stratosphere thin layer of ozone is present. Ozone molecule contains three oxygen atoms. It is blue in colour and has strong odour. Normal oxygen, which we breathe, has two oxygen atoms and is colourless and odourless. Out of each 10 million air molecules, about 2 million are normal oxygen but only 3 are ozone. But a small amount of ozone plays a key role in atmosphere. The ozone layer absorbs the portion of ultraviolet rays, these rays have very harmful effects. It has been recognized since the 1970s that a number of compounds emitted by human activities deplete stratospheric ozone.

Causes of ozone layer depletion: The main things that lead to destruction of the ozone gas in the ozone layer. Low temperatures, increase in the level of chlorine and bromine gases in the upper stratosphere are some of the reasons that lead to ozone layer depletion. But the one and the most important reason for ozone layer depletion is the production and emission of chlorofluorocarbons (CFCs). This is what leads to almost 80 percent of the total ozone layer depletion. There are many other substances that lead to ozone layer depletion such as hydro chlorofluorocarbons (HCFCs) and volatile organic compounds (VOCs). Such substances are found in vehicular emissions, by-products of industrial processes, aerosols and refrigerants. All these ozone depleting substances remain stable in the lower atmospheric region, but as they reach the stratosphere, they get exposed to the ultra violet rays. This leads to their breakdown and releasing of free chlorine atoms which react with the ozone gas, thus leading to the depletion of the ozone layer.

Effects of ozone layer depletion:

Skin Cancer: exposure to UV rays from sun can lead to increased risk for developing of several types of skin cancers. Malignant melanoma, basal and squamous cell carcinoma are the most common cancers caused by exposure to UV rays.

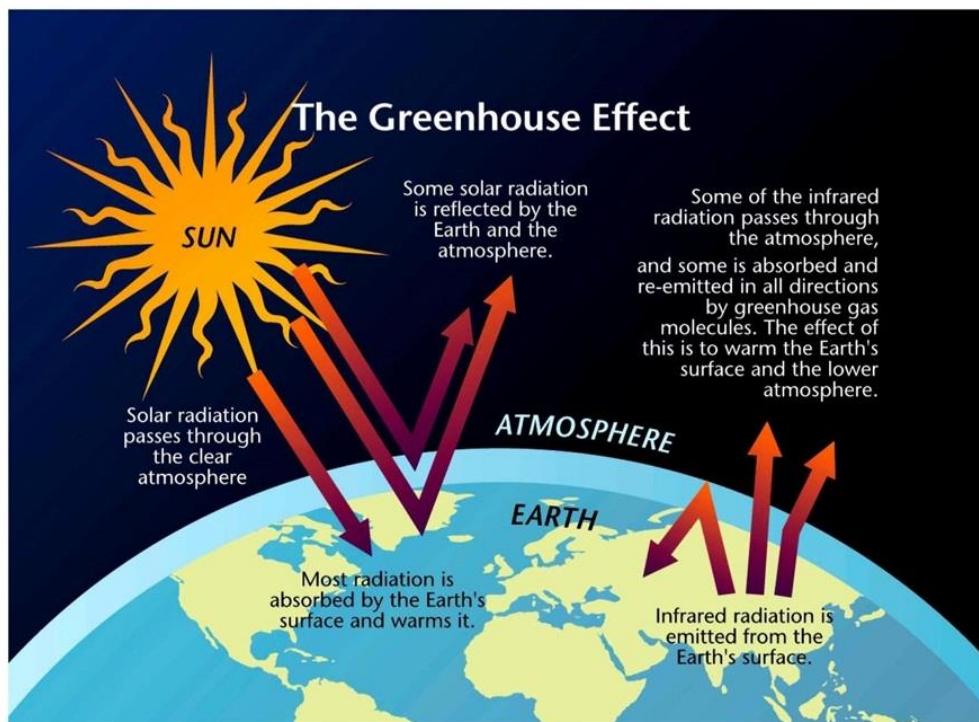
Eye Damage: UV rays are harmful for our eyes too. Direct exposure to UV rays can lead to Cataract problems, and also photokeratitis or snow blindness.

Aging of skin: exposure to UV rays can lead to acceleration of the aging process of your skin. This will result in you looking older than what you actually are. It can also lead to photo allergy that result in outbreak of rashes in fair skinned people.

Ozone layer depletion leads to decrease in ozone in the stratosphere and increase in ozone present in the lower atmosphere. Presence of ozone in the lower atmosphere is considered as a pollutant and a greenhouse gas. Ozone in the lower atmosphere contributes to global warming and climate change. The depletion of ozone layer has trickle down effects in the form of global

warming, which in turn leads to melting of polar ice, which will lead to rising sea levels and climatic changes around the world.

Greenhouse effect: Solar radiations reach the earth's atmosphere. Some of this is reflected back into space. The rest of sun's energy is absorbed by the land and oceans. Heat radiates from earth towards space; some of this heat is trapped by greenhouse gases in the atmosphere keeping the earth warm enough to sustain life. Greenhouse gases includes water vapor, CO₂, CH₄, NO_x, O₃ and some artificial chemicals such as CFCs. Due to some anthropogenic activities increase the amount of greenhouse gases released into atmosphere. This trapping extra heat and causing earth's temperature to rise.



Greenhouse gases:

- Water vapor. The most abundant greenhouse gas, but importantly, it acts as a feedback to the climate. Water vapor increases as the Earth's atmosphere warms, but so does the possibility of clouds and precipitation, making these some of the most important feedback mechanisms to the greenhouse effect.
- Carbon dioxide (CO₂). A minor but very important component of the atmosphere, carbon dioxide is released through natural processes such as respiration and volcano eruptions and through human activities such as deforestation, land use changes, and burning fossil fuels. Humans have increased atmospheric CO₂ concentration by more than a third since the Industrial Revolution began. This is the most important long-lived "forcing" of climate change.

- Methane. A hydrocarbon gas produced both through natural sources and human activities, including the decomposition of wastes in landfills, agriculture, and especially rice cultivation, as well as ruminant digestion and manure management associated with domestic livestock. On a molecule-for-molecule basis, methane is a far more active greenhouse gas than carbon dioxide, but also one which is much less abundant in the atmosphere.
- Nitrous oxide. A powerful greenhouse gas produced by soil cultivation practices, especially the use of commercial and organic fertilizers, fossil fuel combustion, nitric acid production, and biomass burning.
- Chlorofluorocarbons (CFCs). Synthetic compounds entirely of industrial origin used in a number of applications, but now largely regulated in production and release to the atmosphere by international agreement for their ability to contribute to destruction of the ozone layer. They are also greenhouse gases.

Causes of Greenhouse effect:

- Transportation: A Greenhouse gas emission from transportation comes from burning of fossil fuel form our cars, trucks, ships, trains and planes. 90% of fossil fuel is used for transportation.
- Electricity Production: Electricity comes from burning of fossil fuel like coal.
- Industry: Burning of fossil fuels for energy.

Effects:

- Global rise in sea level
- Flooding
- Migration of species
- Impact on agriculture and livestock

Climate Change: Climate is the usual weather of a place. Climate can be different for different seasons. A place might be mostly warm and dry in the summer. The same place may be cool and wet in the winter. Different places can have different climates. You might live where it snows all the time. And some people live where it is always warm enough to swim outside. Climate change is also a change in Earth's climate. This could be a change in Earth's usual temperature. Or it could be a change in where rain and snow usually fall on Earth. Weather can change in just a few hours. Climate takes hundreds or even millions of years to change. Earth's climate is always changing. There have been times when Earth's climate has been warmer than it is now. There have been times when it has been cooler. The earth's climate is vastly different now from what it was 100 million years ago. Climate change is a significant and lasting change in the statistical distribution of weather pattern over periods ranging from decades to millions of years. Earth's temperature has gone up about one degree Fahrenheit in the last 100 years. This may not seem like much. But small changes in Earth's temperature can have big effects.

Causes of climate change:

- Ocean variability: The Ocean is a fundamental part of the climate system, some changes in it occurring at longer time scale than in the atmosphere. It affects water cycle and climate of earth.
- Orbital variations: Slight variations in earth's orbit lead to change in the seasonal distribution of sunlight reaching the earth's surface and how it is distributed across the globe. There is very little change to the area averaged sunshine; but there can be strong changes in the geographical and seasonal distribution.
- Solar radiation: the sun is the predominant source of energy input to the earth. Both long and short term variations in solar intensity are known to affect global climate.
- Volcanism: volcanic eruptions release gases and particulates into atmosphere and it will affect the climate.
- Human influence: fossil fuel combustion, deforestation, land use, agricultural practices, greenhouse gas emission etc.

Nuclear Accidents: when nuclear accidents occur, radiations spread in the environment and people are injured. In world already accidents have occurred and out of these the two most ill famous nuclear accidents are the Three Mile Island reactor 2 in the United States and Chernobyl reactor 4 in former Soviet Union.

The nuclear holocaust causes mass human mortality. The atom bomb used in the second world war by US on the cities of Hiroshima and Nagasaki killed several thousand of innocent people and completely destroyed the cities. Nuclear holocausts are thousand times more powerful than those 2 bombs. Therefore the potential threat of nuclear holocaust is more than ever.

- Nuclear accidents in the world:
 1. 1952 dec. 12 – Chalk River, near Ottawa, Canada – a partial meltdown of reactors uranium fuel core resulted after the accidental removal of four control rods. Millions of gallons of radioactive water accumulated inside the reactor.
 2. 1957 oct. 7 – Windscale pile no.1 north of Liverpool, England, fire in graphite, cool reactor spewed radiation over the countryside, contaminating a 200 square mile area.
 3. 1979 march 28, the three mile nuclear plant, USA – on an island 10 miles away from Harrisburg Pennsylvania the Three Mile Island nuclear power station.
 4. South Ural Mountains – explosion of radioactive waste at soviet nuclear weapons factory 12 mile from city Kyslym forced the evacuation of over 10,000 people from contaminated area.
 5. 1986 April 26, Chernobyl, near Kiev, Ukraine – explosion and fire in the graphite core of one of four reactors release radioactive material that spread over part of soviet union. Eastern Europe, Scandinavia and later Western Europe.

WHO has found that the radiation released from Chernobyl accident was 200 times than that of the Hiroshima and Nagasaki nuclear bombs

combined. According to Ukrainian Radiological Institute, over 2500 deaths resulted from the Chernobyl incident. WHO has found a significant increase in cancer. The rate of thyroid cancer is particularly high.

6. 1999 September 30, Tokaimura, Japan. Uncontrolled chain reaction in uranium – processing nuclear fuel plant spewed high levels of radioactive gas into the air, killing two workers and seriously injuring one other.
- Effects of Nuclear Accidents:
 1. Loss of infrastructure
 2. Causes mass destruction of human lives and other life forms
 3. Harm ozone layer by explosion of nitrogen oxide.
 4. Thyroid cancer: caused due to radioactive iodine this is a common radioactive material used in reactors.
 5. Loss of white blood cells and platelets
 6. Skin cancer due to gamma rays
 7. Genetic mutation

Reduce: The first step towards the effective waste management is to consume only a limited number of resources, which are essential. Some of the benefits of reducing are as follows:

- Helps in saving energy and money.
- Helps in utilizing a product to its fullest extent
- Helps in saving natural resources
- Helps in reducing pollution caused by harvesting of new raw materials.

