# Basics Of Environmental Science And Environmental Issues

# BASICS OF ENVIRONMENTAL SCIENCE

- Environment is everything that is around us which can be living or nonliving thing. It comprises land, water, air, plants and animals.
- On 5 June every year the World Environment Day is celebrated

## ECOLOGY

- The term Ecology was coined by Haeckel
- Ecology is the science section that describes the relationship between living things and other elements in the surrounding environment.

## ECOSYSTEM

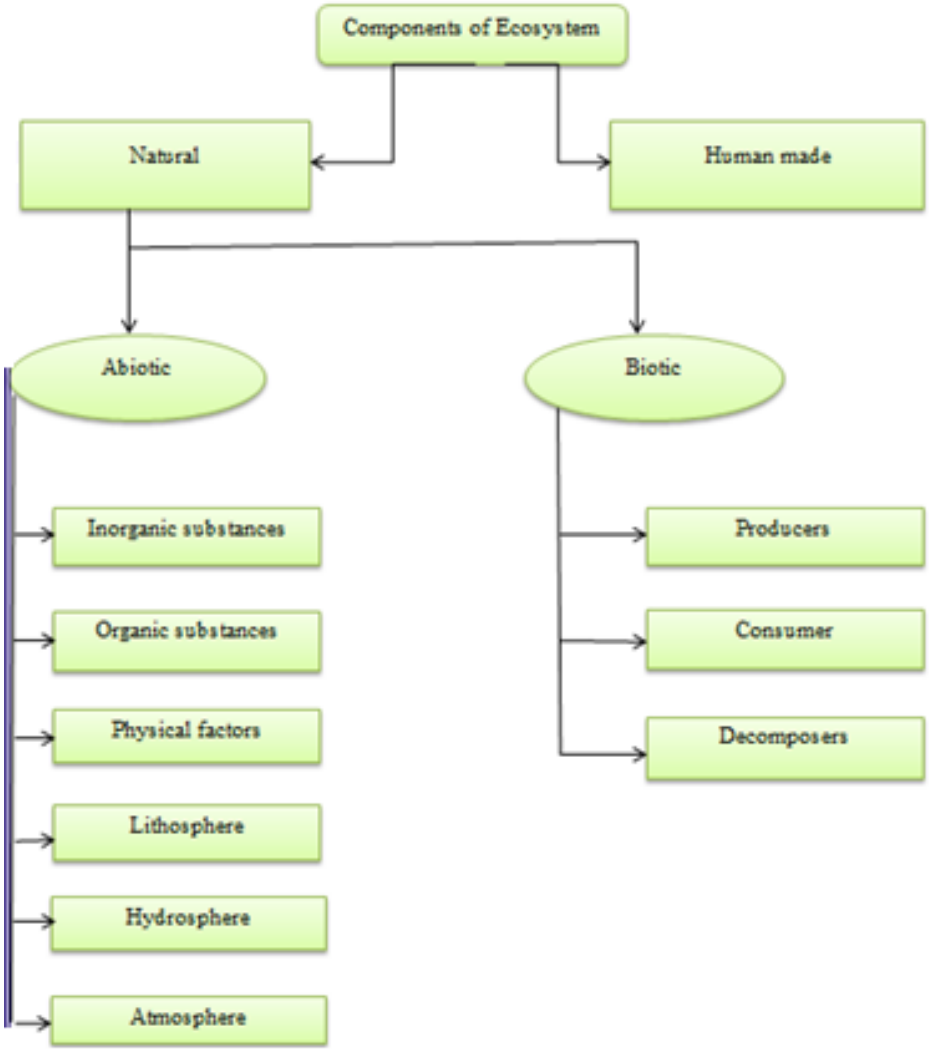
- It is a Structural and functional unit of nature where living organism interact among themselves and also with the surrounding environment
- All the interacting organisms in an area together with the non-living constituents of the environment form an ecosystem
- The term 'ecosystem' was coined by A.G. Tansley in 1935.
- Two components of ecosystem are **Abiotic and biotic.**
  1. Biotic components(all living organisms)
  2. Abiotic components all (non - living components)

### Types of Ecosystem

- Ecosystem can be classified into two types
  1. Terrestrial Ecosystem
  2. Aquatic Ecosystem

## COMPONENTS OF ECOSYSTEM

- Two components of ecosystem are **Abiotic and biotic.**
  1. Biotic components
  2. Abiotic components




**Components of Ecosystem diagram**

## Human Made ecosystem

1. Aquarium
2. Zoo
3. Botanical gardens
4. Agricultural fields
5. orchards

## Natural ecosystems

- Two components of ecosystem are **Abiotic and biotic.**
  1. Biotic components( living organisms)
  2. Abiotic components (non - living components)

**Abiotic components (non - living components)**

- The abiotic component can be grouped into following categories
  1. Inorganic substances
  2. Organic substances
  3. Physical factors
  4. Lithosphere
  5. Hydrosphere
  6. Atmosphere

INORGANIC SUBSTANCES

- Examples: Carbon dioxide, nitrogen, oxygen, phosphorus, sulphur, water, rock, soil and other minerals.

ORGANIC SUBSTANCES

Examples: Carbohydrates, proteins, lipids and Humic substances

PHYSICAL FACTORS

- Examples: Sun light, temperature, rainfall, humidity and pressure. They are influence the growth and development of organisms of biological communities

LITHOSPHERE

- The lithosphere is the outer most part of the Earth. It is made up of rocks and minerals. It is covered by a thin layer of soil.

HYDROSPHERE

- Hydrosphere is made up of all the water and watery layers of the Earth. All of the oceans, lakes, seas and clouds are an example of the hydrosphere.
- The hydrosphere covers 70 percent of the Earth's surface.

ATMOSPHERE

- Atmosphere is a mixture of gases, water vapour and dust particles in different proportions. It is held near the surface of the planet by Earth's gravitational attraction.
- Nitrogen (78%) and Oxygen (21%) are permanent gases of the atmosphere. They constitute 99% of the total composition and their percentages always remain the same without any change. The remaining one percentage is occupied by Argon (0.93%), Carbon-di-oxide, (0.03%), Neon (0.0018%), Helium (0.0005%), Ozone (0.00006%) and Hydrogen (0.00005%).

**Biotic components (Living organisms)**

- The biotic component can be grouped into following categories
  1. Producers
  2. Consumers
  3. Decomposers

PRODUCERS

- Producers (Green plants) are organisms that make their own food through the photosynthesis. They are also known as autotrophs
- Green plants are called autotrophs, as they absorb water and nutrients from the soil, carbon dioxide from the air, and capture solar energy for this process.
  Examples: Green plants, Trees

CONSUMERS

- Consumers are called heterotrophs and they consume food synthesized by the autotrophs.
- It can be divided into three categories
  1. Herbivores or Primary Consumer
  2. Carnivores or Secondary consumers
  3. Omnivores

Herbivores or Primary Consumer

- A herbivore is gets its energy from eating plants

- Examples: Cow, Goat, Horses, Deer, Rhinoceros, Sheep, Rabbit.

### Carnivores or Secondary consumers

- Secondary consumers are organisms that eat primary consumers (Herbivores) for energy.
- Examples: Spider, Eagles, Owls, Cat, Snake, lizard, Dog.

### Omnivores

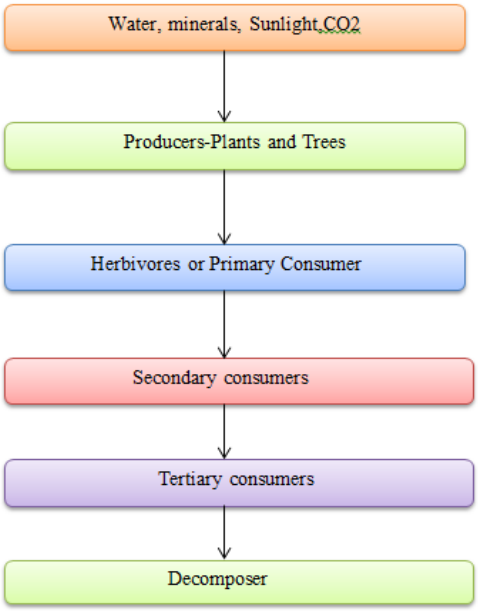
- Omnivores defined as the animals that eat on plants and other animals for nutrition.
- Examples: Chickens, Crows, Humans, Bear, Pigs.

### DECOMPOSERS

- Decomposers are organisms that break down dead plants and animals
- Examples: Bacteria, Fungi.

## FOOD CHAIN

- A **food chain** is a series of organisms where all the organisms are dependent on next organism as a source of **food**
- Food chain Start with **producers**



## Food Web

- Food web is Interlinked arrangement of food chain

## Flow of energy in an ecosystem

- Energy flows in an Ecosystem is always **unidirectional**
- Sun light→Producers→ Herbivores→ Carnivores → Top Carnivores

## Eco-balance

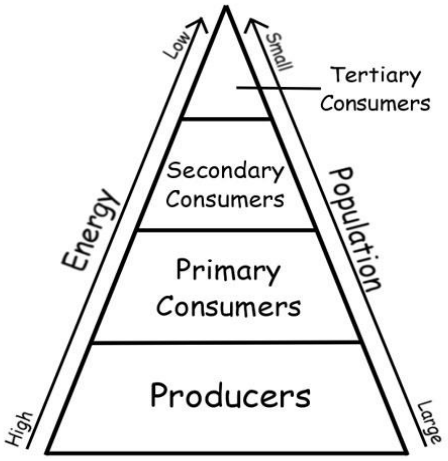
- Ecological balance describe the equilibrium between living organisms such as human being, plants, and animals as well as their environment

## Ecological pyramid and its types

- An ecological pyramid is a graphical representation of the relationship between different organisms in an ecosystem
- The relationship between the number of organism, Biomass and the energy content of producer and consumer at different levels can be represented diagrammatically using ecological Pyramid.
- Three types of pyramid are
  1. Pyramid of energy
  2. Pyramid of Biomass
  3. Pyramid of numbers

### Pyramid of energy

- A **pyramid of energy** is a graphical representation of the amount of **energy** at each trophic level of a food chain
- Pyramid of energy in ecosystem is always upright
- The amount of energy at each trophic level decreases as it moves through an ecosystem.




Pyramid of Biomass

- This pyramid indicates the total mass of the organisms in each trophic level
- In most of the terrestrial ecosystems the pyramid of biomass is **upright**. However, in case of aquatic ecosystems the pyramid of biomass may be **inverted**

Pyramid of Numbers

- A pyramid of numbers is a graphical representation that shows the number of organisms at each trophic level.
- This type of pyramid can have two different forms depending on the number of organisms: upright and inverted.

## ENVIRONMENTAL ISSUES

- Human population size has grown enormously. This means increase in demand for food, water, home, electricity, roads, automobiles and numerous other commodities. These demands are exerting tremendous pressure on our natural resources, and are also contributing to pollution of air, water and soil.

## POLLUTION

- **Pollution** is any undesirable change in physical, chemical or biological characteristics of air, land, water or soil. Agents that bring about such an undesirable change are called as **pollutants**.
  Example: Carbon dioxide, Carbon monoxide, Sulphur dioxide, Lead, etc.

- In order to control environmental pollution, the Government of India has passed the **Environment (Protection) Act, 1986** to protect and improve the quality of our environment (air, water and soil).
- Types of pollution
  1. Air pollution
  2. Water pollution
  3. Soil and land pollution
  4. Sound or noise pollution

## AIR POLLUTION

- Air is a mixture of gases.78% of this mixture is nitrogen and about 21% is oxygen. Carbon dioxide, argon, methane, ozone and water vapour are also present in very small quantities.
- Air is contaminated by unwanted substances which have a harmful effect on both the living and the non-living; it is referred to as air pollution. The substances which contaminate the air are called air pollutants
- In India, the Air (Prevention and Control of Pollution) Act came into force in 1981
- Sources of Pollution can be divided into two types
  1. Natural Sources
  2. Man-made sources

### Natural Sources

- Some of the natural sources of air pollution are volcanic eruptions, forest fires, fog, organic compounds from plants, sea salt.

### Man-made sources

- Air pollution is caused by the burning of combustion material in factories, vehicles and power plants. Air pollution is caused by 50% of vehicle exhaust smoke
- Vehicles produce high levels of pollutants like carbon monoxide, carbon dioxide, nitrogen oxides and smoke.
- **Carbon monoxide** is produced from **incomplete burning of fuels** such as **petrol and diesel**. It is a poisonous gas. It reduces the oxygen-carrying capacity of the blood.
- **Smog** is made up of **smoke and fog**. Smoke may contain oxides of nitrogen which combine with other air pollutants and fog to form smog. The smog causes breathing difficulties such as asthma, cough and wheezing in children

- **Petroleum refineries** are a major source of gaseous pollutants like **sulphur dioxide and nitrogen dioxide**. Sulphur dioxide is produced by combustion of fuels like coal in power plants. It can cause respiratory problems, including permanent lung damage
- **Chlorofluorocarbons(CFCS)** are used in **refrigerator**, CFCs damage the **ozone layer** of the atmosphere
- **Acid rain** corrodes the marble of the monument. The phenomenon is also called **Marble cancer**
- The outer surface of the **Taj mahal has been turning the yellowish** due to atmospheric pollution and also due to excessive presence of **Sulphur Dioxide** in the air due to the Mathura refinery nearby.
- **Ammonia** gas released from **synthetic fertilizer** factories affect the human respiratory tract.
- **Hydrocarbons** are released when burning **coal and petroleum product**

## Acid Rain

- When the **pH value** of the rainwater drops below **5.6**, it is called **acid rain**
- Burning of fossil fuels like Coal, Oil, petrol produces harmful gases like SO2 and NO2.This pollutes air in the atmosphere. It causes rain to be acidic.
- Acid Rain is caused by emissions of **Sulphur dioxide and Nitrogen oxide**
- Acid rain causes respiratory issues in animals and humans.
- Acid rain causes the corrosion of water pipes. Which further results in leaching of heavy metals such as iron, lead and copper into drinking water.
- Acid rain damage buildings and other structures made of stone or metal. The Taj Mahal in India has been affected by acid rain.
- Acid rain removes basic nutrients such as Calcium from the soil

## NOISE POLLUTION

- In India, the Air (Prevention and Control of Pollution) Act came into force in 1981, but was amended in 1987 to include noise as an air pollutant.
- Noise pollution is emission of loud sound which can harmfully impact the humans as well as animal activities for health
- Unit of sound is Decibel (db.)
- The loudness of a sound that a person can withstand without discomfort is about 80 db

### Causes of Noise pollution

- Transport system the main source of noise pollution in urban areas
- Aircraft noise
- Noises from construction works

- Noises from industries
- Because of the use of loudspeakers
- Firecrackers

Effects of noise pollution

- Permanent hearing loss
- Insomnia
- Depression-related diseases

## WATER POLLUTION

- Human beings have been abusing the water-bodies around the world by disposing into them all kinds of waste.
- Government of India has passed the Water (Prevention and Control of Pollution) Act, 1974 to safeguard our water resources.
- Sources of water pollution
  1. Industrial wastes
  2. The surface run off
  3. Thermal and nuclear power stations
  4. Oil spills
  5. Domestic sewage

Domestic sewage

- Sewage from our homes as well as from hospitals are likely to contain many undesirable pathogenic microorganisms, and its disposal into a water without proper treatment may cause outbreak of serious diseases, such as, dysentery, typhoid, jaundice, cholera, etc.

Eutrophication

- Body of water becomes enriched in dissolved nutrients (such as phosphates and nitrates) that stimulate the growth of aquatic plant life usually resulting in the depletion of dissolved oxygen.

Biochemical Oxygen Demand (BOD)

- Biochemical oxygen demand (BOD) is the amount of dissolved oxygen needed by aerobic biological organisms to break down organic material present in a given water sample at certain temperature over a specific time period.

## SOIL AND LAND POLLUTION

- Soil pollution is defined as the change in physical, chemical and biological conditions of the soil through human activities, resulting in the degradation in quality and productivity
- All waste that we generate can be categorized into three types – (a) bio-degradable, (b) recyclable and(c) the non-biodegradable.
- Example of biodegradable waste: Human and animal waste, food waste, paper waste, Remains from the death of living creatures, Organic wastages.
- Example of Non-biodegradable waste: Polyethylene bags, Glass, Metals like aluminium, copper, zinc, iron, Electronic devices, computer parts, batteries, Medical waste, Plastic bags, plastic bottles.

### Causes of soil pollution

1. Acid rain
2. Deforestation
3. Industrial activities
4. Mining activities
5. Accidental oil spills
6. Modern agriculture practices
7. Electronic wastages
8. Disposal of coal Ash

### Effect of soil pollution

1. Reduce Soil fertility
2. Reduce nitrogen fixation
3. Public health problems
4. Poisonous Chemicals entering groundwater

### Control of land pollution

- Irreparable computers and other electronic goods are known as electronic wastes (e-wastes). Recycling is the only solution for the treatment of e-waste.
- Production and use of natural fertilizers
- Afforestation
- Follow 3R(Reduce reuse recycle)
- Dangerous chemical usage should be decreased

- Hospitals generate hazardous wastes that contain disinfectants and other harmful chemicals, and also pathogenic micro-organisms. Such wastes also require careful treatment and disposal
- We can do our bit by carrying cloth or other natural fibre carry-bags when we go shopping and by refusing polythene bags.
- solid waste management is important to prevent land pollution

### Social pollution

- The change in the social structure of the country means social pollution
- Examples: Poverty, Increasing pollution

## GREENHOUSE EFFECT AND GLOBAL WARMING

- The greenhouse effect is a naturally occurring phenomenon that is responsible for heating of Earth's surface and atmosphere. In case without greenhouse effect the average temperature at surface of Earth would have been a chilly –18°C rather than the present average of 15°C.
- The present average temperature of earth is 15 °C (59F)
- Important Greenhouse gases and effects are
  1. Water vapor (30-70%),
  2. Carbon dioxide (9-26%)
  3. Methane
  4. Nitrous oxide (N2O),
  5. Chlorofluorocarbons(CFC)
- Increase the level of greenhouse gases has led to considerable heating of Earth leading to global warming. During the past century, the temperature of Earth has increased by 0.6 oC, most of it during the last three decades
- The **largest contributing** source of greenhouse gas is the burning of fossil fuels leading to the emission of **carbon dioxide** from industries, automobiles and domestic.
- The amount of methane in the atmosphere has doubled since the after the 18th century.
- Scientists believe that this rise in temperature is leading to deleterious changes in the environment and resulting in odd climatic changes (example- El Nino effect) , thus leading to increased melting of polar ice caps as well as of other places like the Himalayan snow caps. Over many years, this will result in a rise in sea level that can submerge many coastal areas.

We can control global warming

- The measures include cutting down use of fossil fuel, improving efficiency of energy usage, reducing deforestation, planting trees and slowing down the growth of human population. International initiatives are also being taken to reduce the emission of greenhouse gases into the atmosphere.

**OZONE Layer Depletion**

- Ozone (O3) is a allotropic form of oxygen. Unlike the normal diatomic molecule of oxygen, ozone is poisonous
- **Three molecules of oxygen** combine to form ozone which forms a layer in **stratosphere**. And it acts as a shield absorbing **ultraviolet radiation** from the **sun**.
- Ozone gas is continuously formed by the action of UV rays on molecular oxygen, and also degraded into molecular oxygen in the stratosphere. There should be a balance between production and degradation of ozone in the stratosphere.
- The balance has been disrupted due to enhancement of ozone degradation by chlorofluorocarbons (CFCs).CFCs find widely used as refrigerants. This has resulted in formation of a large area of thinned ozone layer, commonly called as the ozone hole
- **The thickness of the ozone** in a column of air from the ground to the top of the atmosphere is measured in terms of **Dobson units (DU).**

Some of the Ozone depleting substances are

1. Chlorofluorocarbons (CFCs)
2. Hydrochlorofluorocarbons (HCFCs)
3. hydrobromoflurocarbons (HBFCs)
4. Halons.
5. Methyl bromide.
6. Carbon tetrachloride.
7. Methyl chloroform.

Effects of Ozone layer Depletion

- It causes aging of skin, damage to skin cells and various types of skin cancers
- Immune deficiency disorders
- In human eye, cornea absorbs UV-B radiation, and a high dose of UV-B causes inflammation of cornea, called snow-blindness, cataract, etc.

- UV rays also affect plant growth and reducing agricultural productivity.

Montreal Protocol

- Recognizing the deleterious affects of **ozone depletion**, an international treaty, known as the **Montreal Protocol**, was signed at Montreal (Canada) in 1987 (effective in 1989) to control the emission of ozone depleting substances.

## KYOTO PROTOCOL

- The **Kyoto Protocol** is an international agreement setting targets for industrialized countries to cut **their greenhouse gas emissions**. Certain gases like Carbon dioxide, Methane, Hydro-fluoro carbons etc. are considered at least partly responsible for global warming - the rise in global temperature which may have catastrophic consequences for life on Earth.
- The protocol was agreed to in 1997 in Kyoto in Japan, based on principles set out in UNFCCC.
- The Kyoto Protocol was adopted in Kyoto, Japan on 11 December 1997 and entered into force on 16 February 2005.

## IMPORTANT ONE LINER

1. World environment day is celebrated on **June 5**
2. World Wetland Day is celebrated on **February 2**
3. International Day for biodiversity is observed On **May 22**
4. Two components of ecosystem are **Abiotic and biotic.**
5. The term Ecology was coined by Haeckel
6. The earth is surrounded by huge blanket of air is called **atmosphere**
7. Part of earth having water resources like ocean, river, pond and lakes are called **Hydrosphere**
8. The part of the earth where all life is found is called the **biosphere**
9. **Lichens** used as air pollution indicator
10. Pollution of river water is measured by dissolved amount of **Oxygen**
11. E-wastes are generated from **Discarded electronic equipment**
12. Ecosystem consists of **producers, consumers, Decomposers and Abiotic factors**
13. Energy flows in an Ecosystem is always **unidirectional**
14. Largest share in global mangrove areas are found in **Indonesia**
15. The **Montreal Protocol** is a global agreement to protect the stratospheric **ozone layer**
16. The 'thickness' of Ozone layer is measured in **Dobson unit**

17. The **ozone** layer is a region of Earth's **stratosphere** that absorbs the Sun's **ultraviolet radiation**
18. Ozone Layer is made up of **three oxygen atoms**
19. Food chain Start with **producers**
20. In food chain humans are **Primary and secondary consumer**
21. Bacteria and fungi are called **Decomposers**
22. Food web is Interlinked arrangement of food chain
23. The major pollutant from automobile exhaust is **carbon monoxide**
24. Acid rain is formed due to the contribution from **oxides of Sulphur and nitrogen**
25. Source of geothermal Energy is **Earth**
26. Problem of solid waste disposal can be reduced through **Recycling**
27. Sewage treatment is the process of **treatment of wastewater**
28. Gas that traps heat in the atmosphere is called **Greenhouse gases.** These greenhouse gases include **water vapor, CO2, methane, nitrous oxide (N2O), Chlorofluorocarbons**
29. Greenhouse gas chlorofluorocarbon is produced from **Refrigerator**
30. Ozone layer depletion causes increased UV radiation levels at the Earth's surface. which is damaging to human health. which includes skin cancers, eye cataracts and immunodeficiency disorders
31. **Deforestation** causes Soil erosion, Loss of biodiversity and Disturbance in hydrological cycle
32. Consumers that eat animal flesh as well as plants and plant products are called **omnivores**
33. All Carnivorous animals are **Predators**
34. Thunderstorm and lightning converts atmospheric nitrogen into **nitrates**
35. **Volcano** is natural source of pollution
36. Noise pollution is created if noise is in excess to **80-99 dB**
37. Fish aquarium is an example of **artificial ecosystem**
38. Natural gas, coal and petroleum are the example of **fossil fuels**
39. Constant flow of energy is from **producer to consumer**
40. Representation of biomass energy present in different levels of food chain is classified as **biological pyramid**
41. More than 70 % of worlds freshwater are contained in **polar ice and glaciers** and about 30% is found in **ground water**.
42. BOD stands for **Biochemical oxygen demand**
43. A river with high BOD value is **highly polluted**
44. **Lichen** is the best indicator of SO2 pollution

45. **Oceans** are considered to be the most stable ecosystem in nature.
46. The conservation of selected plants and animals in selected areas outside their natural habitat is known as **ex-situ conservation**. It's includes botanical gardens, zoological gardens and germplasm bank
47. The conservation with in natural habitat is known as **In-situ conservation.** It's includes national parks, wildlife sanctuaries, biospheres reserve etc.
48. The **earthworm** is referred as a farmers friend
49. A primary pollutant is an air pollutant emitted directly from a source. Examples: **Hydrocarbons**, **Carbon monoxide, Sulfur oxides, Nitrogen oxides, lead.**
50. A secondary pollutant is not directly emitted as such, it forms when other pollutants (primary pollutants) react in the atmosphere Examples: **ozone, nitrogen dioxide, sulfur trioxide**
51. Trophic levels are formed by different **organisms linked in a food chain**
52. The Pyramid of energy in Terrestrial ecosystem is always **upright**
53. **Salim Ali** Was an Indian ornithologist and naturalist.
54. **Earth Day** is an annual event celebrated around the world on **April 22** to demonstrate support for environmental protection.
55. The lowest layer of the atmosphere is known as **troposphere**
56. **Photosynthesis** is a process used by the plants make food with the help of the Sun
57. The Green Gold revolution is related to the Promotion and trade of **Bamboo**
58. **Savanna grasslands** are found between tropical rainforest and desert. They are mostly located near the equator. The **largest savanna** is located in **Africa**
59. Earth day is celebrated on **22nd April**
60. Eutrophication means **enrichment of plants nutrients in water bodies.** The most common nutrients causing eutrophication are nitrogen and phosphorus
61. **Biotic components** are the **living things** that shape an **ecosystem.** Examples of biotic components include animals, plants, fungi, and bacteria etc.
62. **Abiotic components** are **non-living** components that influence an **ecosystem.** Examples of abiotic factors are temperature, air currents, and minerals.
63. Percentage of **Nitrogen** in earth atmosphere is **78%**
64. Largest reservoir of **Nitrogen** in **Atmosphere**
65. **Roots** Of plant contains nitrogen fixing **bacteria**
66. Percentage of **Oxygen** in earth atmosphere is **21%**

67. Percentage of carbon dioxide present in atmospheric is **0.0391%**
68. Earth's body temperature is approximately equal to **16.4°C**
69. Bhopal gas tragedy occurred due to the leakage of **Methyl Isocyanate.** Bhopal Gas Tragedy happened in **2 December 1984**
70. **Estuary** means the tidal mouth of a large river
71. As per BIS recommendation, the pH for drinking water should be of the range **6.5 to 8.5.**
72. **Compressed Natural Gas** (CNG) is the best environmentally clean alternative fuel.
73. **Hydrogen** is considered as **energy source of future**
74. **Hydrogen** is found on earth in combination with **Oxygen**. Most of the hydrogen on Earth is in the form of **water**.
75. **Methane** is the main component in **natural gas**. Percentage of methane content of biogas is **50–75 %**
76. **Biodegradable pollutants** are pollutants that are broken down naturally by micro-organisms and are not harmful to the environment. Examples are sewage, paper products, vegetables, juice, seeds and leaves
77. The **non-biodegradable pollutants** are the one that cannot be broken down into smaller, harmless and simpler substances
78. The loudness of a sound that a person can withstand without discomfort is about 80 db
79. 3R of Energy conservation is **reduce, reuse and recycle**