UNIT I

ECOSYSTEMS

**MULTIPLE CHOICE**

1. The organisms which feed on dead organisms , wastes of living organisms are called(Ans: C)
2. Chemotrophs
3. b. carnivores
4. c. detritivores
5. d. decomposers
6. The progressive accumulation of some non biodegradable chemicals through the food chain is known as (Ans: B)

A. ecological balance

b. biological magnification

c. trophic structure

d. bio degradation

1. Gross primary productivity is the highest in (Ans: c)
2. Open oceans
3. grass land s
4. wet tropical forests
5. agrosystems
6. Tropical grassland in Africa with tall grasses scattered with shrubs or stunted trees are called

(Ans: a)

1. Savannas
2. b. pampas
3. c. steppes
4. d. prairies
5. The darker zone in lakes where light penetration is negliginble is called(Ans: c)
6. Littoral zone
7. limnetic zone
8. profundal zone
9. euphotic zone
10. The over nourished lakes with algal blomms are called (Ans: a)
11. Eutrophic
12. oligotrophic
13. dystrophic
14. meromictic
15. Estuaries have following characteristics(Ans: d)

A. fresh and water

b. rich biodiversity

c. high productivity

d. all the above

8. Which one of the following is **not** a functional unit of an ecosystem? (Ans: b)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| A | Productivity | |  | | B.Stratification |
|  |  | |
| C | Energy flow | |  | D.Decomposition | | |
|  |  | |
|  | |

1. The upright pyramid of number is absent in(Ans: d)

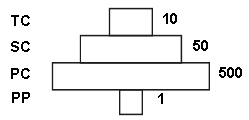
|  |  |
| --- | --- |
| A | Lake |
| B | Grassland |
| C | Pond |
| D | Forest |

10.

1. Which one of the following is **not** a gaseous biogeochemical cycle in ecosystem? (Ans:d)

|  |  |  |
| --- | --- | --- |
| A | Nitrogen cycle | |
| B | Carbon cycle | |
| C | Sulphur cycle | |
| D | Phosphorus cycle | |
|  | |

11. Given below is an imaginary pyramid of numbers. What could be one of the possibilities about certain organisms at some of the different levels? (Ans:c)

[](http://www.questionpapers.net.in/blog/wp-content/uploads/2012/04/imaginary-pyramid-of-numbers.gif)

|  |  |
| --- | --- |
| A | Level one PP is “apal trees” and the level SC is “sheep” |
| B | Level PC is “rats” and level SC is “cats” |
| C | Level PC is “insects” and level SC is “small insectivorous birds” |
| D | Level PP is “phytoplanktons” in sea and “Whale” on top level TC |

11. Identify the possible link "A" in the following food chain: Plant → insect → frog → "A" → Eagle (Ans:a)

|  |  |
| --- | --- |
| A | Cobra |
| B | Parrot |
| C | Rabbit |
| D | Wolf |

13. The type of ecosystem with the highest mean plant productivity is (Ans:a)

|  |  |
| --- | --- |
| A | Tropical rain forest |
| B | Temperate grassland |
| C | Desert |
| D | Tundra |

14. In an aquatic ecosystem, the trophic level equivalent to cows in grasslands is (Ans:b)

|  |  |
| --- | --- |
| A | Nekton |
| B | Zooplankton |
| C | Phytoplankton |
| D | Benthos |

15.The final stable community in ecological succession is (Ans:)

|  |  |
| --- | --- |
| A | Climax |
| B | Sere |
| C | Pioneers |
| D | Carnivores |

16. An ecosystem which can be easily damaged but can recover after some time if damaging effect stops will be having (Ans:d)

|  |  |  |  |
| --- | --- | --- | --- |
| A | High stability and high resilience | | |
| B | Low stability and low resilience | | |
| C | High stability and low resilience | | |
| D | Low stability and high resilience | | |
|  | | | | |
|  |  | |
|  |  | |
|  |  | |
|  |  | |
| 17. Trophic levels in ecosystem is formed by (Ans:d) | | | | |
| A | only herbivores |
| B | only plants |
| C | only bacteria |
| D | Organisms linked in food chain |
|  |  |

18."Complete competitors cannot coexist" is true for (Ans:c)

|  |  |
| --- | --- |
| A | Primary succession |
| B | Secondary succession |
| C | Competitive exclusion |
| D | Character displacement |
|  |  |

19.Bell-shaped polygonal pyramid indicates (Ans:b)

|  |  |
| --- | --- |
| A | Low percentage of young individuals |
| B | Moderate percentage of young individuals |
| C | High percentage of young individuals |
| D | Low percentage of old individuals |
|  |  |

20. The age of pyramid with broad base indicates (Ans:c)

|  |  |
| --- | --- |
| A | High percentage of old individuals |
| B | Low percentage of young individuals |
| C | High percentage of young individuals |
| D..Low percentage of old individuals | |

22. Which one of the following ecosystem types has the highest annual net primary productivity? (Ans:b)

|  |  |
| --- | --- |
| A | Tropical deciduous forest |
| B | Tropical rain forest |
| C | Temperate deciduous forest |
| D | Temperate evergreen forest |

22. A renewable exhaustible natural resource is (Ans:c)

|  |  |  |
| --- | --- | --- |
| A | A.Petroleum | |
| B | B.Coal | |
| C | C.Forest | |
|  | D. Mineral  23 Plants can transform the energy in sunlight into organic molecules such as sugars, in a process called \_\_\_\_\_\_\_\_. (Ans:b)   |  |  | | --- | --- | | A | nitrogen fixation |   B. photosynthesis  c. decomposition  D. cellular respiration  24 Many individuals of the same species living together in a defined area form a/an (Ans:d)  a . community.  b . genus.  c . population.  d . ecosystem.  25 Which of the following is characteristic of parasitism?  (Ans:b)  a . One organism kills and consumes another.  b . Two organisms live together and neither is harmed.  c . Two organisms feed side by side from the same food.  d . Two organisms nourish each other; both benefit.    26 Which of the following terms best describes the inter- relationship between nitrogen‑fixing bacteria and the clover in whose roots they live?  (Ans:a)  a . mutualism  b . commensalism  c . predation  d . parasitism    27 . The progressive series of changes that eventually produce a climax community on what was once a bare rocky island is an example of  a . primary succession.  b . speciation.  c . secondary succession.  d . evolution.  28 . During the growth of a tomato plant from a seed, it increases considerably in biomass.  Which of the following materials, obtained from the environment, are necessary for the growth and increase in biomass? (ANS :D)  a . carbon dioxide, oxygen, and nitrogen  b . water, nitrate, and methane  c. water, carbon dioxide, and mineral salts  d . mineral salts, carbon dioxide, and oxygen  29 . Nitrogen gas returns to the atmosphere by the action of  (ANS :b)  a . nitrogen fixing bacteria.  b . denitrifying bacteria.  c . nitrifying bacteria.  d . nitrate fertilizers.  30 . A molecule of nitrogen which you have just breathed in may have been part of a plant that lived thousands of years ago, or part of a dinosaur that lived millions of years ago.  This illustrates the principle that  a . dead organisms may be fossilized.  b . molecules of cytoplasm may be replaced by inorganic salts.  c . nitrogen does not combine readily with other elements.  d . decay bacteria cycle elements.  e . nitrogen forms part of the proteins of plants and animals.  31 . The sequence of energy flow through a food chain is  a . primary consumers‑ producers‑ higher order consumers.  b . producers‑ higher order consumers‑ primary consumers.  c . higher order consumers‑ primary consumers‑ producers.  d . primary consumers‑ higher order consumers‑ producers.  e . producers‑ primary consumers‑ higher order consumers.  32 . In a terrestrial ecosystem, the trophic level that would contain the largest biomass would be the  a . producers.  b . primary consumers.  c . secondary consumers.  d . highest order consumers.  e . decomposers.  e . nitrogen     33 . The rate of growth of a natural population  a . always reaches the carrying capacity of the ecosystem.  b . is limited by the carrying capacity of the ecosystem.  c . when graphed, always has a positive slope.  d . is calculated by subtracting death rate from birth rate.  e . exceeds the death rate and rate of emigration.  34 . In the past decade, which of the following has NOT been a major cause of the increase in the world's population?    a . longer life span  b . lower infant mortality  c . increase in birth rate  d . modern preventative medicine   |  |  | | --- | --- | | http://wps.aw.com/wps/media/objects/11277/11547832/_skins_/P/places_blue/ps_bkgd_lower_left.gif |  | | |
|  | |  |

**SHORT ANSWERS:**

**1. Define Environmental Sciences?**

Ans: Environmental Sciences is a multi-disciplinary science which comprises chemistry, physics, biological and agricultural sciences and public health. (or) The study of Environment and its relationships with other living and non-living organisms.

**2. Define Environment?**

Ans: Environment means the biotic and abiotic components that surround us. Biotic (living) components includes: Human beings, animals, plants, insects, bacteria and viruses whereas Abiotic (non-living) component includes: air, water and soil.

**3. Atmosphere?**

Ans: The atmosphere is the layer of air that surrounds the earth. It is about 150 km thick. It is divided into: troposphere, stratosphere, mesosphere and thermosphere, Ionosphere and Exosphere.

**Troposphere:** The lowest layer of atmosphere from the earth surface. Wind, storms, rain and thunders occur in this region. It is 11 km above from the earth surface.

**Stratosphere:** A layer above the troposphere that is 50 km above from the earth’s surface . Ozone layer is present in this layer.

**Mesosphere:** It is 85 km above from the earth surfaces. The mesosphere is also the layer in which a lot of meteors burn up while entering the Earth's atmosphere. From the Earth they are seen as shooting stars.

**Thermosphere:** It is 500km above from the earth surface. Within the thermosphere temperatures rise continually to well beyond 1000°C. The few molecules that are present in the thermosphere receive extraordinary amounts of energy from the Sun, causing the layer to warm to such high temperatures.

**Ionosphere:** In this region of the atmosphere the Sun's energy is so strong that it breaks apart molecules and atoms of air, leaving ions (atoms with missing electrons) and free-floating electrons.

**Exosphere:** The exosphere is the highest layer of the atmosphere. Together with the ionosphere, it makes up the thermosphere. The exosphere extends to 10,000 km above the Earth's surface. This is the upper limit of our atmosphere. The atmosphere here merges into space in the extremely thin air. Air atoms and molecules are constantly escaping to space from the exosphere. In this region of the atmosphere, hydrogen and helium are the prime components and are only present at extremely low densities. This is the area where many satellites orbit the Earth.

**4.Define Ecology?**

Ans:Ecology deals with study of organisms in their natural home interacting with their surroundings. It was derived from Greek word Oikos(home) and logos(study) was coined by Earnest Hackel in 1869.

**5. Define Eurythermal organisms?**

Ans:Organisms present in estuaries show a wide range of tolerance of temperature and salinity.Estaury is the region where both Salt water and fresh water joins.

**6. Food chain?**

Ans: The sequence of transfer of food from one level to another.

**7. Food web?**

Ans: Food web consists of ‘n’ number of food chains.

**8. Ecological pyramids?**

Ans: Graphic representation of trophic structure and functions of an ecosystem, starting with producers at the base and successive trophic levels forming the apex is known as an ecological pyramid. It includes 3 different types: 1.Pyramid of number (pyramid built based upon numbers) 2. Pyramid of Biomass (based on biomass biomass is the waste coming from plants) and 3. Pyramid of Energy (based upon energy levels)

Note: Pyramid of Energy only always upright it will never be downward.

**9. Primary production?**

Ans:It is defined as the rate at which radiant energy is converted into organic substances by photosyntheisis.

NPP=GPP-R

**10. Secondary production?**

Ans:The amount of organic matter stored by the herbivores or carnivores is known as secondary production.

11**. Define Cybernetics?**

Ans: The science of self-regulation is called as cybernetics. It consists of two feedback mechanisms 1. Positive feedback mechanism-In which ecosystem collapse or dies and 2. Negative feedback mechanism- in which ecosystem survives.

**12.Define carrying capacity?**

Ans: The number of individuals of a given species that can be sustained (live) indefinitely in a given space is known as the carrying capacity. It include two factors 1. Biotic potential (ability to grow)and 2. Environmental resistance(limiting factors which helps to stop the over growth of population by Shortage of food, space, shelter etc).

**13. Biogeochemical cycles?**

Ans: Bio-geochemical cycles include Water cycles, Oxygen cycles, Nitrogen cycles, Phosphorus cycles.

**14. Bio-magnification?**

Ans: Increase of chemical concentration from one level to another is termed as Bio-magnification.

**15. Bio-accumulation?**

Ans: **Bioaccumulation** refers to the accumulation of substances, such as [pesticides](http://en.wikipedia.org/wiki/Pesticides), or other organic chemicals in an organism. Bioaccumulation occurs when an organism absorbs a [toxic substance](http://en.wikipedia.org/wiki/Toxin) at a rate greater than that at which the substance is lost.

**16. Define Ecology?**

Ans: The study of interaction between living organisms and their environment.

**III. ESSAY TYPE QUESTIONS:**

1**..DEFINE ECOLOGY AND ECOSYSTEMS.**

|  |  |
| --- | --- |
|  | An ecosystem includes all of the living things (plants, animals and organisms) in a given area, interacting with each other, and also with their non-living environments (weather, earth, sun, soil, climate, atmosphere).  **Ecology** () is the [scientific](https://en.wikipedia.org/wiki/Science) analysis and study of interactions among organisms and their environment. It is an [interdisciplinary](https://en.wikipedia.org/wiki/Interdisciplinary) field that includes [biology](https://en.wikipedia.org/wiki/Biology), [geography](https://en.wikipedia.org/wiki/Geography), and [Earth science](https://en.wikipedia.org/wiki/Earth_science). Ecology includes the study of interactions [organisms](https://en.wikipedia.org/wiki/Organism) have with each other, other organisms, and with [abiotic components](https://en.wikipedia.org/wiki/Abiotic_component) of their [environment](https://en.wikipedia.org/wiki/Environment_%28biophysical%29).  2.What are the biotic and a biotic components of an ecosystem?  All ecosystems consist of two major components—biotic and abiotic. The biotic component is comprised the living organisms, whereas the abiotic component includes the physical (non-living) environment. But, both of these components interact very closely to exhibit a definite structural organization. Sometimes, it is very difficult to separate the biotic components from the abiotic com­ponents.  **Biotic Component:**  When we consider the biotic components, the organisms are divided into two categories, the autotrophs and the heterotrophs. The autotrophs can produce their own food. They are the green plants with chlorophyll and certain types of bacteria—chemosynthetic and photosynthetic. Since these organisms produce food for all other organisms, they are also known as ‘Producer’. The het­erotrophs depend directly or indirectly on the autotrophs for their food. This type of organisms is further divided into two groups, such as, Photographs and Osmotrophs.  The photographs take food from outside and digest it inside their bodies. They are called consumers. All animals—herbivores (plant eating), carnivores (animal eating) or omnivores (eating all kinds of food) fall in this group. The osmotrophs are those organisms who secrete digestive enzymes to break down the food into simpler substances and then absorb the digested food.This group embraces the parasitic and saprophytic bacteria as well as the fungi. They may also be called Decomposers because their role has been well documented in the decomposition of the dead organic matter. But the most interesting point is that all of these parasites are not decomposers, rather some of them are consumers (insects and such small animals) who help in the decomposition by breaking down the dead organic matter into small bits. However, the heterotrophs can also be divided into two broad groups as the bio phages (feeding on living organisms) and the sarcophagus (feeding on dead organisms)  A Classification of the Biotic Components based on Food Abiotic Component: **Abiotic component of ecosystem refers to the physical environment and its several interacting variables which can be divided into four folds:**  (i) Lithosphere which means the solid mineral matter on the earth and the land form as well;  (ii) Hydrosphere, i.e. the water in oceans, lakes, river, ice-caps, etc.;  (iii) Atmosphere, the gaseous mixture in the air; and  (iv) The radiant solar energy.  The position and movement of the earth with its gravitational force are additional components of the environment Fig. 10.4. However, these components create invariability of magnitude and duration of other envi­ronmental factors.  The Abiotic Components and their Interactions |

The energy interacts with rocks, water and gases to produce a complex environ­ment with a large number of identifiable variables such as heat, light, rain, wind, snow, fog, dust, storm, fire, etc. Thus, by the interaction of variables, the environment is created and maintained as a unit where any single component cannot be removed or altered without disturbing the other compo­nents.

**3.WHAT ARE FOOD CHAINS AND FOOD WEBS? GIVE EXAMPLES AND DISCUSS THEIR SIGNIFICANCE.**

Every plant and animal species, no matter how big or small, depends to some extent on another plant or animal species for its survival. It could be bees taking pollen from a flower, photosynthesis of plants, deer eating shrub leaves or lions eating the deer.

**A Food Chain** shows how energy is transferred from one living organism to another via food. It is important for us to understand how the food chain works so that we know what are the important living organisms that make up the food chain and how the ecology is balanced.

**Types of Food Chains found in an  Ecosystems: Grazing and Detritus Food Chain!**

In nature, basically two types of food chains are recognized – grazing food chain and detritus food chain.

#### 1. Grazing food chain:

This type of food chain starts from the living green plants goes to grazing herbivores, and on to carnivores. Ecosystems with such type of food chain are directly dependent on an influx of solar radiation.

This type of chain thus depends on autotrophic energy capture and the movement of this captured energy to herbivores. Most of the ecosystems in nature follow this type of food chain. The phytoplanktons →zooplanktons →Fish sequence or the grasses →rabbit →Fox sequences are the examples, of grazing food chain.

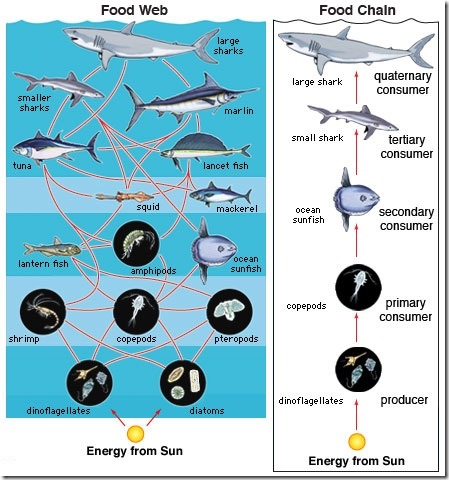
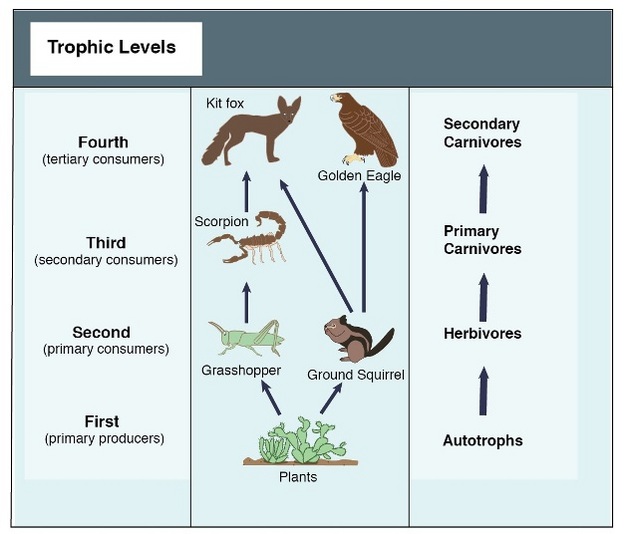
#### 2. Detritus food chain:

This type of food chain goes from dead organic matter into mi­croorganisms and then to organisms feeding on detritus (detrivores) and their predators. Such ecosystems are thus less dependent on direct solar energy. These depend chiefly on the influx of organic matter produced in another system. For example, such type of food chain operates in the decomposing accumulated litter in a temperate forest.

#### Significance of food chain:

1. The studies of food chain help understand the feeding relationship and the interaction between organisms in any ecosystem.
2. They also help us to appreciate the energy flow mechanism and matter circulation in ecosystem and understand the movement of toxic substances in the ecosystem.
3. The study of food chain helps us to understand the problems of bio-magnification

**Food Web** Food web is an important conceptual tool for illustrating the feeding relationships among species within a community, revealing species interactions and community structure, and understanding the dynamics of energy transfer in an ecosystem.

Food web offers an important tool for investigating the ecological interactions that define energy flows and predator-prey relationship . Figure 1 shows a simplified food web in a desert ecosystem. In this food web, grasshoppers feed on plants; scorpions prey on grasshoppers; kit foxes prey on scorpions. While the food web showed here is a simple one, most feed webs are complex and involve many species with both strong and weak interactions among them . For example, the predators of a scorpion in a desert ecosystem might be a golden eagle, an owl, a roadrunner, or a fox. 

# Applications of Food Webs

## Food webs are constructed to describe species interactions (direct relationships).

The fundamental purpose of food webs is to describe feeding relationship among species in a community. Food webs can be constructed to describe the species interactions

## Food webs can be used to illustrate indirect interactions among species.

Indirect interaction occurs when two species do not interact with each other directly, but influenced by a third species. Species can influence one another in many different ways

## food webs can be used to study bottom-up or top-down control of community structure.

Food webs illustrate energy flow from primary producers to primary consumers (herbivores), and from primary consumers to secondary consumers (carnivores).

## Food webs can be used to reveal different patterns of energy transfer in terrestrial and aquatic ecosystems.

Patterns of energy flow through different ecosystems may differ markedly in terrestrial and aquatic ecosystems (Shurin et al. 2006). Food webs (i.e., energy flow webs) can be used to reveal these differences.

1. **WHAT ARE THE ECOLOGICAL PYRAMIDS ? EXPLAIN WHY SOME OF THESE PYRAMIDS ARE UPRIGHT WHILE OTHERS ARE INVERTED IN DIFFERENT ECOSYSTEMS**

**ECOLOGICAL PYRAMIDS :**

Graphical representation of trophic structure and function of an ecosystem , starting with producers at the base and successive trophic levels forming the apex is known as an ecological pyramid.

ECOLOGICAL PYRAMIDS ARE 3 TYPES

1. **PYRAMID OF NUMBERS:** it represents the number of individual organisms at each trophic level .

There are three of pyramid of numbers:

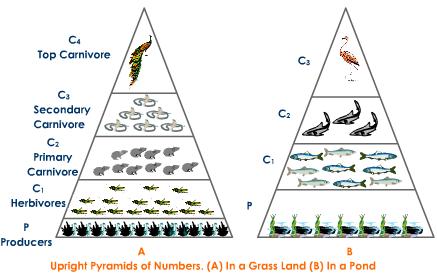
* Upright pyramid of number
* Partly upright pyramid of number and
* Inverted pyramid of number.

Pyramid of numbers are upright or inverted pyramids, depending on the type of ecosystem and food chain

* Upright Pyramid of Number

This type of pyramid number is found in the aquatic and grassland ecosystem, in these ecosystems there are numerous small autotrophs which support lesser herbivores which in turn support smaller number of carnivores and hence this pyramid is upright.

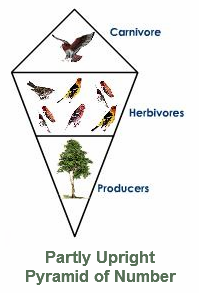
Ex; Grass land ecosystem and a pond ecosystem show upright pyramid of numbers.



* Partly Upright pyramid of Number

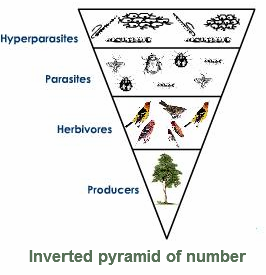
It is seen in the forest ecosystem where the number of producers are lesser in number and support a greater number of herbivores and which in turn support a fewer number of carnivores.

Forest ecosystem:



* Inverted Pyramid of Number

This type of ecological pyramid is seen in parasitic food chain where one primary producer supports numerous parasites which support more hyperparasites.



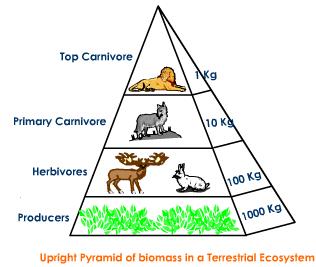
1. **PYRAMID OF BIO MASS**

The pyramid of biomass is more fundamental, they represent the quantitative relationships of the standing crops. In this pyramid there is a gradual decrease in the biomass from the producers to the higher trophic levels. The biomass here the net organisms collected from each feeding level and are then dried and weighed. This dry weight is the biomass and it represents the amount of energy available in the form of organic matter of the organisms. In this pyramid the net dry weight is plotted to that of the producers, herbivores, carnivores, etc.

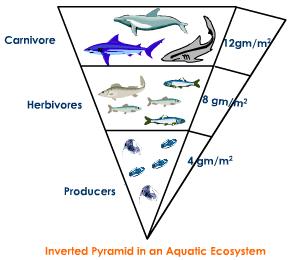
There are two types of pyramid of biomass, they are:

* Upright pyramid of biomass and
* Inverted pyramid of biomass.
* **UPRIGHT PYRAMID OF BIOMASS**

This occurs when the larger net biomass of producers support a smaller weight of consumers.   
Example:forestecosystem.



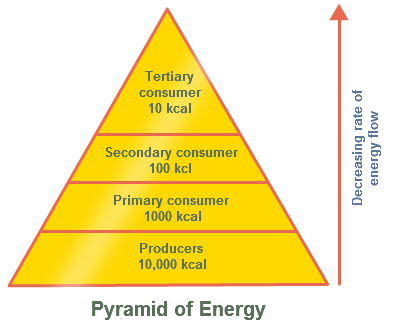
**INVERTED PYRAMID OF BIOMASS**This happens when the smaller weight of producers support consumers of larger weight.   
Example: Aquatic ecosystem

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## PYRAMID OF ENERGY

The pyramid of energy or the energy pyramid describes the overall nature of the ecosystem. During the flow of energy from organism to other, there is considerable loss of energy in the form of heat. The primary producers like the autotrophs there is more amount of energy available. The least energy is available in the tertiary consumers. Thus, shorter food chain has more amount of energy available even at the highest trophic level.

* The energy pyramid always upright and vertical.
* This pyramid shows the flow of energy at different trophic levels.
* It depicts the energy is minimum as the highest trophic level and is maximum at the lowest trophic level.
* At each trophic level, there is successive loss of energy in the form of heat and respiration, etc.

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1. **DISCUSS THE MODELS OF FLOW OF ENERGY**

**FLOW OF ENERGY:**

All organisms equire energy, for growth, maintenance, reproduction, locomotion, etc., Hence, for all organisms there must be:   
A source of energy   
A loss of usable energy

**Types of energy**

heat energy

mechanical energy (+gravitational energy, etc.)

chemical energy = energy stored in molecular bonds

**An ecosystem has abiotic and biotic components:**

ABIOTIC COMPONENTS:

Solar energy provides practically all the energy for ecosystems.

Inorganic substances, e.g., sulfur, boron, tend to cycle through ecosystems.

Organic compounds, such as proteins, carbohydrates, lipids, and other complex molecules, form a link between biotic and abiotic components of the system.

**BIOTIC components:**

The biotic components of an ecosystem can be classified according to their mode of energy acquisition.

In this type of classification, there are: Autotrophs and Heterotrophs

**Autotrophs**

Autotrophs (=self-nourishing) are called primary producers.

**Photoautotrophs** fix energy from the sun and store it in complex organic compounds (= green plants, algae, some bacteria)

**Chemoautotrophs** (chemosynthesizers) are bacteria that oxidize reduced inorganic substances (typically sulfur and ammonia compounds) and produce complex organic compounds

Other chemoautotrophs: Nitrifying bacteria in the soil under our feet

**Heterotrophs:** Heterotrophs (=other-nourishing) cannot produce their own food directly from sunlight+ inorganic compounds.They require energy previously stored in complex molecules.

Heterotrophs can be grouped as: consumers and decomposers

* Consumers feed on organisms or particulate organic matter.
* Decomposers utilize complex compounds in dead protoplasm.

Bacteria and fungi are the main groups of decomposers.

Bacteria are the main feeders on animal material.

Fungi feed primarily on plants, although bacteria also are important in some plant decomposition processes.

**The Laws of Thermodynamics**

Energy flow is a one-directional process.

sun---> heat (longer wavelengths)

**FIRST LAW Of THERMODYNAMICS**: Energy can be converted from one form to another, but cannot be created or destroyed.

**SECOND LAW of THERMODYNAMICS**

Transformations of energy always result in some loss or dissipation of energy

or

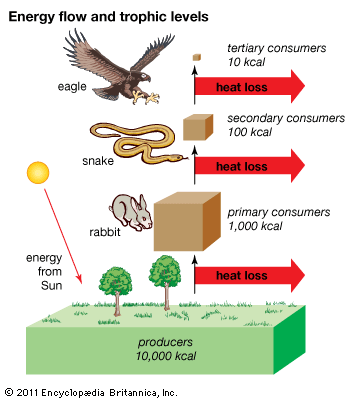
In energy exchanges in a closed system, the potential energy of the final state will be less than that of the initial state

or

Entropy tends to increase (entropy = amount of unavailable energy in a system)

or

Systems will tend to go from ordered states to disordered states (to maintain order, energy must be added to the system, to compensate for the loss of energy



**6.DISCUSS THE BIO GEO CHEMICAL CYCLES? EXPLAIN WITH THE HELP OF A DIAGRAM THE NITROGEN CYCLEAND PHOSPHOROUS CYCLES?**

**BIO GEO CHEMICAL CYCLES( NUTRIENT CYCLES):**

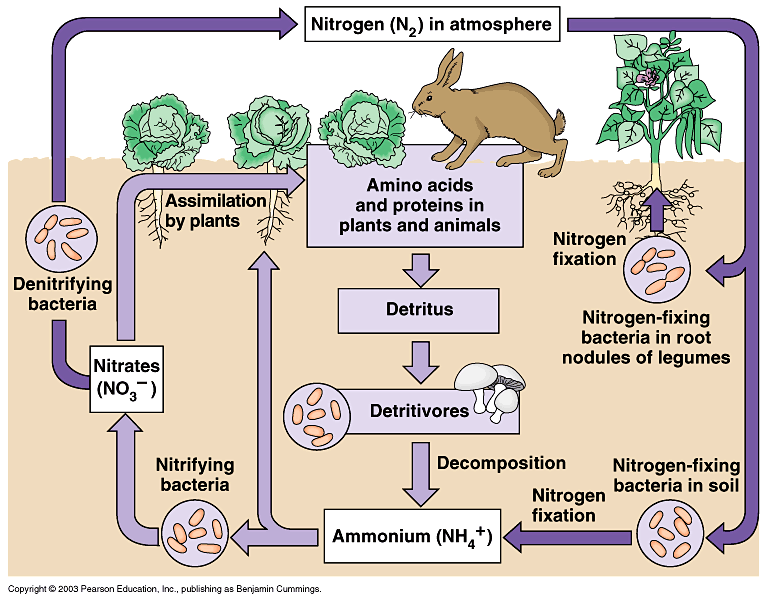
In [Earth science](https://en.wikipedia.org/wiki/Earth_science), a **biogeochemical cycle** or **substance turnover** or **cycling of nutrients** is a pathway by which a [chemical substance](https://en.wikipedia.org/wiki/Chemical_substance) moves through both the biotic ([biosphere](https://en.wikipedia.org/wiki/Biosphere)) and abiotic ([lithosphere](https://en.wikipedia.org/wiki/Lithosphere), [atmosphere](https://en.wikipedia.org/wiki/Atmosphere), and [hydrosphere](https://en.wikipedia.org/wiki/Hydrosphere)) components of [Earth](https://en.wikipedia.org/wiki/Earth).

The term "biogeochemical" tells us that biological, geological and chemical factors are all involved. The circulation of chemical nutrients like carbon, oxygen, nitrogen, phosphorus, calcium, and water etc. through the biological and physical world are known as biogeochemical cycles.

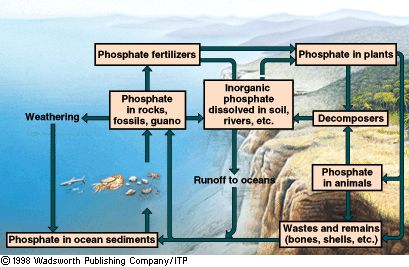
**NITROGEN CYCLE**

* 78% of the volume of trophosphere
* Most complex cycle
* N2 gas can’t be used ‘as is’ – it must be ‘fixed’ so that organisms can use it
* Steps to the cycle: b/c of complexity, no certain order
  + N Fixation – occurs in plant, by bacteria
  + Ammonification
  + Nitrification
  + Assimilation
  + Denitrification
* N2 gas is modified by “nitrogen-fixing” bacteria in legumes into ammonia (NH3) – **NITROGEN FIXATION** – aids in production of sugars/starches
* Bacteria turn wastes and detritus into ammonia – **AMMONIFICATION** – released into atm
* NH3 is converted into nitrite (NO2-) which is then used to produce nitrate (NO3-) - **NITRIFICATION**

Nitrogen cycle (con’t)

* Plant roots take up the ammonia and nitrate ions and converts it into amino acids, proteins, DNA/RNA = **ASSIMILATION**
* other bacteria convert nitrite (NO2-) into N2 gas - **DENITRIFICATION**
* nitrogen, present in proteins, moves through the food chain as one organism eats another
* 

**.PHOSPHORUS CYCLE**

* phosphorus is released as rocks erode and plants assimilate this
* Very slow process
* phosphorus passes from one organism to another in the food chain
* decomposers release phosphorus during decomposition
* Mined for production of fertilizer. Mined in Tampa, FL
* 

**7.DEFINE AND EXPLAIN BIOMAGNIFICATION AND CARRYING CAPACITY**

**Biomagnification**, also known as **bioamplification** or **biological magnification**, is the increase in [concentration](http://en.wikipedia.org/wiki/Concentration_(chemistry)) of a substance that occurs in a [food chain](http://en.wikipedia.org/wiki/Food_chain) as a consequence of:

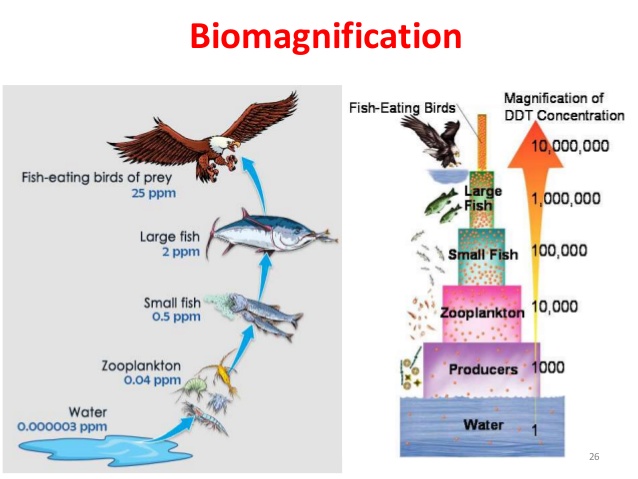
* Persistence (can't be broken down by environmental processes)
* [Food chain](http://en.wikipedia.org/wiki/Food_chain) [energetics](http://en.wikipedia.org/wiki/Bioenergetics)
* Low (or nonexistent) rate of internal degradation/excretion of the substance (often due to water-insolubility)

**Substances that biomagnify**

Metals are not degradable because they are elements. Organisms, particularly those subject to naturally high levels of exposure to metals, have mechanisms to sequester and excrete metals. Problems arise when organisms are exposed to higher concentrations than usual, which they cannot excrete rapidly enough to prevent damage. Some persistent [Heavy metals](http://en.wikipedia.org/wiki/Heavy_metal_(chemistry)) are especially harmful to the organism's reproductive system.

**organic substances**

: Persistent organic pollutant

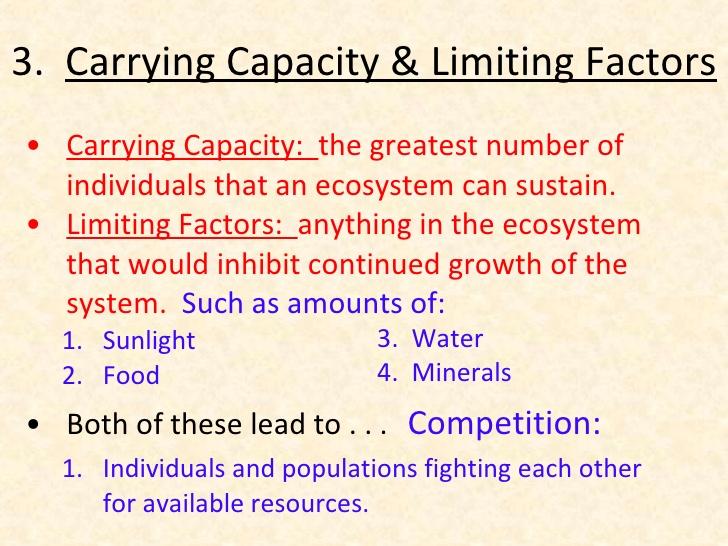
* [DDT](http://en.wikipedia.org/wiki/DDT) ,[HCB](http://en.wikipedia.org/wiki/HCB) s,[PCBs](http://en.wikipedia.org/wiki/Polychlorinated_biphenyl) ,[Toxaphene](http://en.wikipedia.org/wiki/Toxaphene) , [Monomethylmercury](http://en.wikipedia.org/wiki/Monomethylmercury) ,
* **Inorganic substances:** [Heavy metal](http://en.wikipedia.org/wiki/Heavy_metal_(chemistry)) ; [Arsenic](http://en.wikipedia.org/wiki/Arsenic) ,[Cadmium](http://en.wikipedia.org/wiki/Cadmium) ,[Mercury](http://en.wikipedia.org/wiki/Mercury_(element)) ,[Selenium](http://en.wikipedia.org/wiki/Selenium)
* ****

**8. DEFINE CARRYLING CAPACITY**

The **carrying capacity** of a biological [species](https://en.wikipedia.org/wiki/Species) in an [environment](https://en.wikipedia.org/wiki/Natural_environment)

It is the maximum population size of the species that the environment can sustain indefinitely, given the food, [habitat](https://en.wikipedia.org/wiki/Habitat), [water](https://en.wikipedia.org/wiki/Drinking_water), and other [necessities available](https://en.wikipedia.org/wiki/Resource) in the environment.

In [population biology](https://en.wikipedia.org/wiki/Population_biology), carrying capacity is defined as the [environment](https://en.wikipedia.org/wiki/Environment_%28biophysical%29)'s maximal load, which is different from the [concept](https://en.wikipedia.org/wiki/Concept) of population equilibrium. Its effect on [population dynamics](https://en.wikipedia.org/wiki/Population_dynamics) may be approximated in a [logistic model](https://en.wikipedia.org/wiki/Logistic_function), although this simplification ignores the possibility of [overshoot](https://en.wikipedia.org/wiki/Overshoot_%28population%29) which real systems may exhibit.



**9. EXPLAIN THE VALUES OF ECOSYSTEM**

ECO SYSTEM VALUE:

Economists assign several types of values to ecosystems:

\*direct use value attributed to direct utilisation of ecosystem services;

\*indirect use value attributed to indirect utilisation of ecosystem services, through the positive [externalities](http://en.wikipedia.org/wiki/Externalities) that ecosystems provide;

\*option value attributed to preserving the option to utilise ecosystem services in the future;

\*existence value attributed to the pure existence of an ecosystem

\*altruistic value based on the welfare the ecosystem may give other people

\*request value based on the welfare the ecosystem may give future generations

**Ecosystems products and services**

**PRODUCTS**

* Food, Fuel wood ,Non-timber forest products , Fisheries products ,Marine products ,Wetlands products , Medicinal and biomedical products ,Forage and agricultural products, Water ,Reeds, Building material

**FUNCTIONS/SERVICES**

* hydrological services,Purification of water, Capture, Storage and release of surface and groundwater ,Mitigation of floods and droughts ,Biodiversity ,Maintenance of biodiversity (plants and animals) ,Climate ,Partial stabilization of climate through carbon sequestration ,Moderation of temperature extremes and the force of winds and waves

**ECOSYSTEM SERVICES**

PROVISIONING, REGULATING, SUPPORTING,CULTURAL

**POVISIONING SERVICES -** These are the most obvious and are the varied products or materials that we extract from different ecosystems for human use in its broadest sense.

They include plant and animal material for direct consumption as food, other plant or animal materials such as wood, plant fibers or skins and sinews employed in shelters and clothing, herbs of medicinal value and even water that is trapped in rain in elevated forested areas and fed into streams and aquifers, and even water that may be used to generate energy.

**REGULATING SERVICES -** Regulating services include a diversity of natural processes that provide stability to ecosystems and are beneficial to all life, including man of course. .

One most important service is water and air purification. Another is decomposition of wastes, particularly organic wastes. Another is pollination f many plants.

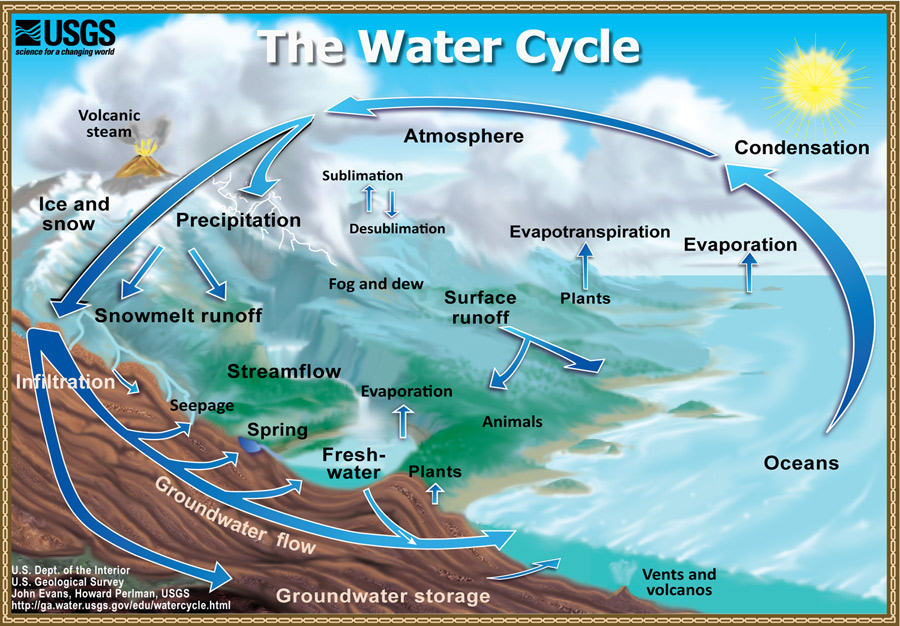
Again another service is pest and disease regulation. Perhaps the one that may not be as obvious is carbon sequestration and its role in climate regulation.

1. **EXPLAIN WATER AND CARBON CYCLE**

The water cycle has no starting point, but we'll begin in the [oceans](https://water.usgs.gov/edu/watercycleoceans.html), since that is where most of Earth's water exists. The sun, which drives the water cycle, heats water in the oceans. Some of it [evaporates](https://water.usgs.gov/edu/watercycleevaporation.html) as vapor into the air; a relatively smaller amount of moisture is added as ice and snow [sublimate](https://water.usgs.gov/edu/watercyclesublimation.html) directly from the solid state into vapor. Rising air currents take the vapor up into the [atmosphere](https://water.usgs.gov/edu/watercycleatmosphere.html), along with water from [evapotranspiration](https://water.usgs.gov/edu/watercycleevapotranspiration.html), which is water transpired from plants and evaporated from the soil. The vapor rises into the air where cooler temperatures cause it to [condense](https://water.usgs.gov/edu/watercyclecondensation.html) into clouds.

Air currents move clouds around the globe, and cloud particles collide, grow, and fall out of the sky as [precipitation](https://water.usgs.gov/edu/watercycleprecipitation.html). Some precipitation falls as snow and can accumulate as [ice caps and glaciers](https://water.usgs.gov/edu/watercycleice.html), which can store frozen water for thousands of years. Snowpacks in warmer climates often thaw and melt when spring arrives, and the melted water flows overland as [snowmelt](https://water.usgs.gov/edu/watercyclesnowmelt.html). Most precipitation falls back into the oceans or onto land, where, due to gravity, the precipitation flows over the ground as [surface runoff](https://water.usgs.gov/edu/watercyclerunoff.html). A portion of runoff enters rivers in valleys in the landscape, with [streamflow](https://water.usgs.gov/edu/watercyclestreamflow.html) moving water towards the oceans. Runoff, and groundwater seepage, accumulate and are [stored as freshwater](https://water.usgs.gov/edu/watercyclefreshstorage.html) in lakes.

Not all runoff flows into rivers, though. Much of it soaks into the ground as [infiltration](https://water.usgs.gov/edu/watercycleinfiltration.html). Some of the water infiltrates into the ground and replenishes [aquifers](https://water.usgs.gov/edu/watercyclegwstorage.html) (saturated subsurface rock), which store huge amounts of freshwater for long periods of time. Some infiltration stays close to the land surface and can seep back into surface-water bodies (and the ocean) as [groundwater discharge](https://water.usgs.gov/edu/watercyclegwdischarge.html), and some groundwater finds openings in the land surface and emerges as freshwater [springs](https://water.usgs.gov/edu/watercyclesprings.html). Yet more groundwater is absorbed by plant roots to end up as evapotranspiration from the leaves. Over time, though, all of this water keeps moving, some to reenter the ocean, where the water cycle "ends" ... oops - I mean, where it "begins."



* 1. Carbon cycle

carbon is present throughout the natural environment in a fixed amount. It takes many forms and moves through the environment via the carbon cycle.

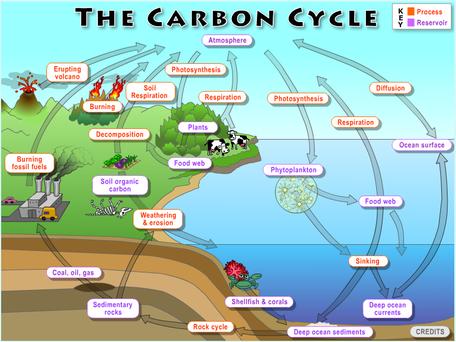
The carbon cycle is the circulation and transformation of carbon back and forth between living things and the environment. Carbon is an element, something that cannot be broken down into a simpler substance. Other examples of elements are oxygen, nitrogen, calcium, iron, and hydrogen. Carbon compounds are present in living things like plants and animals and in nonliving things like rocks and soil. Carbon compounds can exist as solids (such as diamonds or coal), liquids (such as [crude oil](https://teeic.indianaffairs.gov/glossary/glossary.htm#31)), or gases (such as [carbon dioxide](https://teeic.indianaffairs.gov/glossary/glossary.htm#343)). Carbon is often referred to as the "building block of life" because living things are based on carbon and carbon compounds.

## Carbon Moves between Sources and Sinks

One important aspect of the carbon cycle is the speed with which carbon moves from a carbon source to a carbon sink and then back again. Some living things grow and decompose more quickly than others. For example, living things with shells, like oysters or snails, take a longer time to decompose than "squishy" living things like slugs or tomatoes. The rate of [decomposition](https://teeic.indianaffairs.gov/glossary/glossary.htm#516), and the resulting release of carbon, can be hastened by the actions of specialized microscopic and macroscopic plants and animals, called "decomposers," that break down plant and animal matter. The decomposition process ends up creating carbon dioxide and other gases, such as [methane](https://teeic.indianaffairs.gov/glossary/glossary.htm#112). Plant and animal growth and decomposition occur simultaneously, all the time. We see live trees growing, and leaf litter and downed trees rotting in the same forest,

**HUMAN ACTIVITY:-**

For most of the history of the earth, significant amounts of carbon remained locked up in the subsurface in coal and oil and gas deposits. Since the start of the industrial age, however, humans have harvested and burned these deposits for energy, releasing the carbon compounds that were stored in the coal, oil, and gas deposits back into the atmosphere as carbon dioxide and other gases. Significant amounts of carbon compounds are being released into the atmosphere as a result of human activity, much faster than they would have been released naturally, and this rapid release is the primary cause of currently observed anthropogenic (human-influenced) [global warming](https://teeic.indianaffairs.gov/glossary/glossary.htm#82). The figure to the right depicts carbon dioxide emissions from energy generation sources in the US in 2003.



Unit-2 NATURAL RESOURCES

I. MULTIPLE CHOICE QUESTIONS

1. **A non-renewable source of energy is** (Ans:b)  
   (a) Wild life (b) Fossils fuels  
   (c) Water (d) Forest

|  |  |
| --- | --- |
| 1. **A plant endemic to India is** (Ans:a)(a) Banyan (b) Ginkgo (c) Sequoia (d) Triticum |  |

1. **A renewable exhaustible natural resource is**  (Ans: a)  
   (a) Forest (b) Coal  
   (c) Petroleum (d) Minerals
2. **A species restricted to a given area is** (Ans: a)  
   (a) Endemic species (b) Allopatric species  
   (c) Sympatric species (d) Sibling species
3. **According to IUCN red list, what is the status of Red Panda (Ailurus fulgens)**(a) Critically endangered (b) Endangered species  
   (c) Vulnerable species (d) Extinct species
4. **Deforestation brings about** (Ans: a)  
   (a) Soil erosion (b) Weed control  
   (c) Decreases drought (d) Increased sunlight
5. **Deforestation is caused due to** (Ans: b)  
   (a) Silviculture (b) Construction of roads  
   (c) Rainfall (d) Plantation of trees
6. **Deforestation is the major causal agent of** (Ans: c)  
   (a) Depletion of natural resources  
   (b) Environmental pollution  
   (c) Desertification of habitat  
   (d) Genetic erosion
7. **Deforestation will decrease** (Ans: d)  
   (a) Soil erosion (b) Land slides  
   (c) Soil fertility (d) Rainfall
8. **Kaveri water dispute is in between:** (Ans: d)

(a) India and Pakistan (b) Punjab and Haryana

(c) Uttar Pradesh and Madhya Pradesh (d) Karnataka and Tamil Nadu

**11. In respect of water crisis, there have been conflicts/disputes between two Countries or states of the same country. Which of the following has never been the case of water conflict? (Ans:d)**

(a)Cauvery water dispute between Tamil Nadu and Karnataka

(b)Yamuna-Betwa dispute between U.P. and M.P.

(c)Sutlej Yamuna Link (SYL) canal dispute between Punjab and Haryana

(d)Jordan, Tigris-Euphrates, and Nile river basins dispute among Jordan, Syria and

Israel

**12. The method of rainwater harvesting which can be adopted by individual house owners is (Ans:d)**

(a) Construction of recharge trenches

(b) On channel storage of water

(c) Creation of new water bodies

(d) Roof-top rainwater harvesting

**13. Which one of the following is not an ideal solution for tackling water shortages?**

**(Ans: d)**

(a) Controlling population growth

(b) Conserving water in irrigation

(c) Controlling water pollution

(d) Drilling large number of deep bore wells

**14. When fluoride concentration in H2O exceeds about 1.5 mg/1, the disease that may be caused, is (Ans: b)**

(a) Dental caries in children

(b) Fluorosis

(c) Polymyelitis

(d) Methemoglobinemia

**15. Which of the following is not a method for water conservation? (Ans:b)**

(a) Rainwater harvesting

(b) Groundwater extraction

(c) Improving irrigation efficiency

(d) Avoiding water wastage

**16. Given below are some statements: (Ans: b)**

A. About 60% of human body is water

B. About 96% of total fluoride in human body is found in bones and teeth

C. Most adults consume about 1 to 3 mg of fluoride daily

D. Soft water usually contains 10 ppm fluoride and hard water contains no fluoride. Of these the correct statements are:

(a) A, B and D

(b) A, B and C

(c) B, C and D

(d) A, B, C and D

**17. the teeth are likely to be pitted, more susceptible to cavities and wear, when the fluoride concentration is:** (Ans:d)

(a) More than 2 mg/1

(b) More than 40 mg/1

(c) More than 20 mg/1

(d) More than 4 mg/1

**18. Fossil fuel and metallic minerals are:** (Ans:c)

(a) Renewable resource

(b) Inexhaustible resources

(c) Non-renewable resources

(d) None of these

**19. Khetri (Rajasthan) is famous for:** (Ans:b)

(a) Coal mines

(b) Copper mines

(c) Granite stone

(d) Marble stone

**20.In our country the percentage of land under forest is about: (Ans:b)**

(a) 20%

(b) 19%

(c) 25%

(d) 30%

**21. Which of the following statements about the forest is not correct? (Ans:d)**

(a) Forest reduces soil erosion

(b) Provides recreational opportunities

(c) Provides economic development

(d) None of the above

**22.Forest and wild life are (Ans: a)**

(a) Renewable resource

(b) Non-renewable resources

(c) Inexhaustible resources

(d) None of these

**23. Which of the following is not true about deforestation? (Ans:c)**

(a) Population explosion is one of the reasons for deforestation.

(b) Cleaning of forest for agriculture causes deforestation.

(c) Deforestation is taking place only in developing courtiers.

(d) Cash crop economy of third world is a cause of deforestation.

**24. Deforestation generally decreases (Ans:a)**

(a) Rainfall

(b) Soil erosion

(c) Draught

(d) Global warming

**25. Which of the following is not a viable protection against deforestation? (Ans:c)**

(a) Reduce the consumption of forest and related products

(b) Boycott products of companies involve in deforestation

(c) Privatisation of forest land

(d) Environmental education

**26. Extensive planting of trees to increase cover is called (Ans:a)**

(a) Afforestation

(b) Agroforestation

(c) Deforestation

(d) Social forestry

**27. Which of the following is responsible for desertification? (Ans:d)**

(a) Deforestation

(b) Mining

(c) Overgrazing

(d) All of the above

**28. Forests prevent soil erosion by binding soil particles in their (Ans:b)**

(a) Leaves

(b) Roots

(c) Buds

(d) Stems

**29. The major cause for land degradation in our country is (Ans:a)**

(a) Soil erosion

(b) Pollution of soil

(c) Water-logging

(d) None of the above

**30. Nitrogen constitutes about 78% of the atmosphere (Ans:c)**

(a) By weight

(b) By mass

(c) By volume

(d) None of these

**31. Carbon dioxide constitutes about 0.03% of the atmosphere (Ans:a)**

(a) By volume

(b) By weight

(c) By mass

(d) None of these

**32. Which among the following is a sedimentary type of cycle? (Ans: a)**

(a) Sulphur cycle

(b) Nitrogen cycle

(c) Oxygen cycle

(d) Carbon cycle

**33. The percentage of total world’s precipitation, which is lost to the atmosphere through evaporation, approximates to: (Ans:a)**

(a) 57%

(b) 7%

(c) 37%

(d) 43%

II. SHORT ANSWER TYPE QUESTIONS

**1.Define natural resources?**

Ans: Any stock or reserve that can be drawn from nature is called as Natural resources.

**2. Renewable and Non-renewable resources?**

Ans: Renewable resources: the resources which are easily regenerated are termed as Renewable resources Ex: Water, Solar, Geo-thermal energy, Ocean thermal Energy, Bio-fuel, Tidal energy etc.

Non-renewable energy resources: The resources which take much time to regenerate are termed as non-renewable energy resources. Ex: Coal, Petrol, Nuclear energy.

**3. What are Aquifers?**

A layer of sediment that is highly permeable and contains water is called an Aquifers. There are two types of aquifers are their namely 1. Confined aquifers and 2. Unconfined aquifers.

Confined aquifers: It is present in between the two impermeable layers (which cannot absorb water) therefore in this region the water availability is very less.

Unconfined aquifers: This is the layer present below the permeable layer (which absorbs water) and this region contains much water.

**4. Define Minerals?**

Minerals are naturally occurring, inorganic, crystalline solids having a definite chemical composition and characteristics physical properties. Minerals can be extracted through mining process.

**5. Solar energy?**

The energy coming from sun is termed as solar energy.

**6. Ocean thermal Energy conversion (OTEC):**

The energy available due to the differences in temperature of water at the surface of tropical oceans and at deeper levels is called as OTEC. A difference of 20 c or more is needed to run the OTEC plant. We use liquid ammonia as a working fluid in the OTEC plant.

**7. Geo-thermal energy?**

Energy coming from Earth is called as Geo- thermal energy.

**8. Biogas?**

Biogas is a mixture of methane, carbon dioxide, hydrogen and hydrogen sulfide, the major constituents being methane. Bio-gas is produced by the degradation of animal waste.

**9. Coal?**

Coal comes under non-renewable energy resources. Different forms of coal are as follows: Antharacite(hard coal),Bituminous(soft coal),Lignite(brown coal) and peat(young coal).

**10. Natural gas?**

It is mainly composed of methane (95%) with small amount of propane and ethane. It is cleanest fossil fuel. It can be easily transported through pipelines.

**11. What are Zooplanktons?**

Zooplankton is the primary consumers that feed on Phytoplankton’s (algae). These are the small animal organisms floating on the water surfaces.

**12. Eutrophication?**

Over nourishment of water due to excessive nitrates and phosphates.(or) The water which contains More amount of Nitrates and Phosphates.

13**. Soil Erosion?**

Washing away of fine fertile soil is called soil erosion.

**14. Oligotrophic lakes?**

The lakes which contain less nutrients are called as Oligotrophic lakes.

**15. Eutrophic lakes?**

The lakes which contains More nutrients are called as Eutrophic lakes

III. ESSAY TYPE QUESTIONS

**1. What are renewable and non renewable resources? Give examples.**

A. **Renewable resources** are resources that are replenished by the environment over relatively short periods of time. This type of resource is much more desirable to use because often a resource renews so fast that it will have regenerated by the time you've used it up.

Ex: forests, wild life, wind energy, biomass energy, tidal energy, hydropower, solar energy etc

**Non-Renewable resources** are resources that are not easily replenished by the environment once they are exhausted

Ex: fossil fuels, like coal, petroleum, minerals

**2. Discuss the major uses of forests. How would you justify that ecological uses of forests surpass commercial uses?**

A.Commercial Uses

Forests provide us a large number of commercial goods which include timber, firewood,

pulpwood, food items, gum, resins, non-edible oils, rubber, fibers, bamboo canes, medicine,

drugs, and many more items, the total worth of which is estimated to be more than $300

billion per year.

* Half of the timber cut each year is used as fuel for heating and cooking.
* One third of the wood harvest is used for building materials as lumber, plywood and hardwood, particle board and clipboard
* One sixth of the wood harvest is used for paper industry
* Many forest lands are used for mining, agriculture, grazing and for development of dams.

Ecological Uses:

While a typical tree produces commercial goods worth about $590 it provides environmental services worth nearly $196, 250. The ecological services provided by our forests may be summed up as follows.

1. Production of oxygen:

The trees produce oxygen by photosynthesis which is so vital for life on this

earth. They are likely called as earth’s lungs.

2. Reducing global warming:

The main greenhouse gas carbon dioxide (CO2) is observed by the forests as a raw material for photosynthesis. Thus the forest canopy acts as a sink for co2 there by reducing the problem of global warming caused by green house gas co2.

3. Wild life habitat:

Forests are the homes of millions of wild animals and plants. About 7 million species are found in the tropical forests alone.

4. Regulation of hydrological cycle:

Forested watersheds act like giant sponges, absorbing the rainfall, slowing down the runoff and slowly releasing the water for recharge of springs. About 50-80% of the moisture in the air above tropical forests comes from their transpiration which helps in bringing rains.

5. Soil conservation:

Forests bind the soil particles tightly in their roots and prevent soil erosion.

6. Pollution moderators:

Forests can absorb many toxic gases can help in keeping the air pure. They have also been reported to absorb noise and thus help in preventing air and noise pollution.

7. Driving energy flow and nutrient cycling:

Their huge biomass and enormous biological and biochemical diversity support energy flow and nutrient cycling.

**3. What are the major causes and consequences of Deforestation?**

A. Deforestation is one of the major causes to the environmental degradation which is affected by the agents like small farmers, ranches, loggers and plantation companies. There is a broad consensus that expansion of cropped areas and pastures are a major source of deforestation.

The term ‘deforestation’ describes the complete long term removal of tree cover. The loss forest cover influences the climate and contributes to a loss of biodiversity. The economic activity is adversely affected by siltation, flooding, soil degradation and reduced timber supplies. Thus, in turn, threatens the livelihood of people.

**Causes for Deforestation:**

**1. Shifting cultivation:**

There are an estimated 300 million people living a shifting cultivator who practice slash and burn agriculture and are supposed to clear more than 5 Lakh ha of forest for shifting cultivation annually. In India, we have this practice in north-east and to some extent in Andhra Pradesh, Bihar and M.P which contribute to nearly half of the forest clearing annually

**2. Agriculture:**

Conversion of forests to agricultural land to feed growing needs of people. There are an estimated 300 million people living as shifting cultivators who practice slash and burn agriculture and are supposed to clear more than 5 lakh ha of forests for shifting cultivation annually. In India, we have this practice in North-east and to some extend in Andhra Pradesh, Bihar and M.P. which contribute to nearly half of the forest clearing annually.

**3. Commercial logging:**

(Which supplies the world market with woods such as meranti, teak, mahogany and ebony) destroys trees as well as opening up forest for agriculture. Cutting of trees for fire wood and building material, the heavy lopping of foliage for fodder and heavy grazing of saplings by domestic animals like goals.

**4. Mining:**

This causes environmental impacts like erosion, formation of sinkholes, loss of biodiversity, and contamination of soil, groundwater and surface water by chemicals from mining processes. In some cases, additional forest logging is done in the vicinity of mines to increase the available room for the storage of the created debris and soil.

#### Contamination resulting from leakage of chemicals can also affect the health of the local population if not properly controlled. Extreme examples of pollution from mining activities include coal fires, which can last for years or even decades, producing massive amounts of environmental damage.

#### 5. Increase in population:

The needs also increase and utilize forests resources. To meet the demands of rapidly growing population, agricultural lands and settlements are created permanently by clearing forests.

#### 6. Urbanization and industrialization:

Since Industrialization and Urbanization needs land to grow, so major amount of forest lands are cut in order to promote Industrialization and Urbanization. This creates harmful effect on environment and forest ecological balance.

#### 7. Construction of dam reservoirs:

For building big dams, large scale devastation of forests takes place which breaks the natural ecological balance of the region. Floods, droughts and landslides become more prevalent in such areas. Forests are the repositories of invaluable gifts of nature in the form of biodiversity and by destroying these we are going to lose these species even before knowing them. These species could be having marvelous economic or medicinal value. These storehouses of species which have evolved over millions of years get lost due to deforestation in a single stroke.

#### 8. Forest fires:

They may be natural or manmade, and cause huge forest loss.

#### 9. Overgrazing:

Overgrazing occurs when plants are exposed to intensive grazing for extended periods of time, or without sufficient recovery periods. It can be caused by either livestock in poorly managed agricultural applications, or by overpopulations of native or non- native wild animals. Overgrazing reduces the usefulness, productivity, and biodiversity of the land and is one cause of desertification and erosion. Overgrazing is also seen as a cause of the spread of invasive species of non-native plants and of weeds.

### Consequences of Deforestation:

Depending on the needs of the social group concerned, deforestation has made it possible for communities to be built. Forest makes way for residential houses, office buildings and factories. Governments are able to built reads to make trade and transport easier and therefore more convenient to residents.

Deforestation can also mean the conversion of forest land to productive land for agricultural uses. This results in better and more abundant production of food and materials, virtually eradicating periods of want and lack. Economically, deforestation has contributed much in giving many communities the opportunity to make positive changes in their times. Unfortunately, the negative consequences of deforestation for outweigh its positive effects.

**Here are few of them.**

#### 1. Food problems:

Most of the area that has undergone deforestation is actually unsuitable for long-term agricultural use such as ranching and forming. Once deprived of their forest cover, the lands rapidly degrade in quality, losing their fertility and arability.

The soil in many deforested areas is also unsuitable for supporting annual crops. Much of the grassy areas are also not as productive compared to more arable soils and are therefore not fit for long-term cattle grazing.

#### 2. Exposing soil to heat and rain:

Heavy rainfall and high sunlight quickly damage the topsoil in clearings of the tropical rain forests. In such circumstance, the forest will take much longer to regenerate and the land will not be suitable for agricultural use for quite some time.

#### 3. Flooding:

Deforestation can results to watersheds that are no logger able to sustain and regulate water flows from rivers to steams. Trees are highly effective in absorbing water quantities, keeping the amount of water in watersheds to a manageable level. The forest also serves as cover against erosion. Once they are gone, too much water can results to downstream flooding, many of which have cause disasters in many parts of the world.

The fertile top soil is eroded and flooded into the lower regions, many coastal fisheries and coral reefs suffer from the sedimentation brought by the flooding. This results to negative effects in the economic viability of many business and fatalities in wildlife population.

#### 4. Loss of biodiversity:

This is probably most serious consequence of Deforestation. Put simply, it means the destruction and extinction of many plants and animal species, many of un-home remain unknown and whose benefits will be left undiscovered.

#### 5. Displacement of indigenous communities:

Some indigenous people’s may of life and survival are threatened by the loss of forests. Fewer trees results an in secure future for forests workers.

#### 6. Climate change:

Deforestation can cause the climate to become extreme in nature. It increases CO2 concentration in atmosphere and contributes to global warming.

#### 7. Economic loss:

The occurrence of floods and droughts are affecting the economy. It also leads to loss of future markets for ecotonism. The value of a forest is often higher when it is left standing than it could be worth when it is harvested.

#### 8. Health issues:

The stress of environmental change may make some species more susceptible to the effect of insects, pollution and diseases.

**4. Discuss with the help of a case study, how big dams have affected forests and the tribal’s.**

**A.** Dams are the massive artificial structures built across the river to create a reservoir in order to store water for many beneficial purposes. Big dams and river valley projects (RVP) have multi-purpose uses and have been referred to as “Temples of modern India”. In a developing country like India, more than 75% of the population depends on agriculture; the execution of river valley project is an important element of growth strategy. India has more than 1550 large dams, the maximum being in the state of Maharashtra (>600), followed by Gujarat (>250) and M.P (>130).

Although these projects have several benefits, they also have cost the society a great deal. The biggest economic social and environment cost of river valley project is the submergence of large tracts of lands, forests, dwellings, railways and roads

For example Narmada RVP, will submerge tracts, 23km of railways, 85km of roads,45km of telephone lines, 10,000 buildings and 3300 drinking wells.

1. Effect on Tribal people:

The greatest social cost of big dam is the widespread displacement of local people. It is estimated that the number of people affected in India over the past 50 years can be as high as 20 millions. The Hirakud dam, one of the largest dams executed in fifties, has displaced more than 20,000 people residing in 250 villages.

2. Effect on Forests:

Thousands of hectares of forests have been cleared for executing river valley projects. For example, the Narmada project alone has submerged 1, 44,731 ha of land, out of which 56,547 ha is forest land.

3. Effect on wild Animals:

Construction of dams under these projects will lead to lose of wild animals.

4. Effect on Environment:

The big river valley projects also cause water logging which leads to salinity and in turn reduces the fertility capacity of the land.

**5. Briefly discuss droughts and floods with respect to their occurrence and impacts?**

A. **FLOODS**

It is a natural event or occurrence where a piece of land (or area) that is usually dry land, suddenly gets submerged under water. Some floods can occur suddenly and recede quickly. Others take days or even months to build and discharge.

When floods happen in an area that people live, the water carries along objects like houses, bridges, cars, furniture and even people. It can wipe away farms, trees and many more heavy items.   
 Flooding is extremely dangerous and has the potential to wipe away an entire city, coastline or area, and cause extensive damage to life and property. It also has great erosive power and can be extremely destructive, even if it is a foot high.

Here are a few events that can cause flooding:  
  
 a) Heavy rains  
 b) River overflow: Rivers can overflow their banks to cause flooding  
 c) Strong winds in Coastal areas: Sea water can be carried by massive winds and hurricanes dry coastal lands and cause flooding.

**Impacts of floods:**

* As most people are well aware, the immediate impacts of flooding include loss of human life, damage to property, destruction of crops, loss of livestock, and deterioration of health conditions owing to waterborne diseases. As communication links and infrastructure such as power plants, roads and bridges are damaged and disrupted, some economic activities may come to a standstill, people are forced to leave their homes and normal life is disrupted.
* Similarly, disruption to industry can lead to loss of livelihoods. Damage to infrastructure also causes long-term impacts, such as disruptions to supplies of clean water, wastewater treatment, electricity, transport, communication, education and health care. Loss of livelihoods, reduction in purchasing power and loss of land value in the floodplains can leave communities economically vulnerable.
* Floods can also traumatise victims and their families for long periods of time. The loss of loved ones has deep impacts, especially on children. Displacement from one's home, loss of property and disruption to business and social affairs can cause continuing stress. For some people the psychological impacts can be long lasting.

**DROUGHTS**

A **drought** is a period of below-average precipitation in a given region, resulting in prolonged shortages in its water supply, whether atmospheric, [surface water](https://en.wikipedia.org/wiki/Surface_water) or [ground water](https://en.wikipedia.org/wiki/Ground_water). A drought can last for months or years, or may be declared after as few as 15 days. It can have a substantial impact on the [ecosystem](https://en.wikipedia.org/wiki/Ecosystem) and [agriculture](https://en.wikipedia.org/wiki/Agriculture) of the affected region and harm to the local [economy](https://en.wikipedia.org/wiki/Economy). Annual dry seasons in the [tropics](https://en.wikipedia.org/wiki/Tropics) significantly increase the chances of a drought developing and subsequent bush fires. Periods of heat can significantly worsen drought conditions by hastening evaporation of [water vapor](https://en.wikipedia.org/wiki/Water_vapour).

**Causes of drought:**

Natural/physical causes:

-Weather: increased amount of anticyclone weather (hot and dry) means air holds less moisture so you get less rain.

-Global warming: weather patterns change (eg: sahel is becoming hotter and drier)

-Hotter weather: more evaporation than precipitation

-EI Nino: random weather event that reverses normal weather patterns (e.g. Australia has years of drought and then years of flood)

Human causes:

-Over population: Too many people living in an area using too much water

-over cultivation: Planting too many crops which use up too much water

-Over extraction: removing too much water from wells so they dry up

-Deforestation: cutting down trees which otherwise store water and hold soil together

-politics: fighting over water or companies being greedy and taking too much water to then sell on

**Impacts of Drought:**

* Economic impact: agriculture and the income generated from crops in short term and unemployment of farmers and even retailers can occur at long term
* Environmental impact: insect infestations and plant diseases, increased erosion, habitat and landscape degradation in short term and plant and animal species can suffer tremendously and over time desertification can happen with an extreme lack of moisture at long term
* Social impact: disputes between users of available water, inequalities in water distribution between wealthy and poor, siparties in areas in need of disaster relief and a decline in health.

**6. What are the major causes for conflicts over water?**

A. Conflict means a situation in which people, groups, countries are involvedin a serious argument. Water is an essential resource for sustaining life and environment. The available water resources are under tremendous pressure due to increased demands. Conflicts over sharing of river water between neighboring countries or different states of a country have now become quite common. The conflicts over water are continuing phenomena and leads to wars.

Some examples of such conflicts in past & at present are listed below:

* During Second World War many water dams were bombed.
* Central dams over YALU River were attacked during Korean War.
* Water supply systems in North Vietnam were bombed by US in1960’s during Vietnam War.
* The construction of Farakka Barrage across Ganga has become a dispute between India and Bangladesh. The Barrage is intended to divert water into river Hoogly to protect Calcutta port.
* The Cauvery water dispute is between the states of Tamil Nadu and Karnataka. Tamil Nadu is occupying the downstream region of the river wants to use of upstream water whereas the upstream state Karnataka refused to do so.
* The Sutlej –Yamuna link is the dispute between Punjab & Haryana.
* The river basin of Fordan and the Nile are the shared water resources for Middle East Countries (Asia; Africa; Europe ). Ethiopia controls 80% of Nile River water whereas Sudan (South Africa) too is trying to divert more water. The sufferer is Egypt.

The following statuses have disputes:

|  |  |  |
| --- | --- | --- |
|  | **Rivers** | **Disputing states** |
| 1. | Yamuna | Delhi, Haryana, Rajasthan, Himachal Pradesh, Uttar Pradesh. |
| 2. | Narmada | Maharashtra, Gujarat, Rajasthan, Madhya Pradesh |
| 3. | Krishna | Andhra Pradesh, Maharashtra, Tamil Nadu, Karnataka. |
| 4. | Godavari | Andhra Pradesh, Maharashtra, Orissa, Madhya Pradesh. |
| 5. | Cauvery | Tamil Nadu, Karnataka |

**7. What are the major environmental impacts of mineral extraction and its remedies and Give an account on some case studies of mineral resources?**

A. **Mineral Resources:**

Minerals are naturally occuring inorganic, crystalline, solid having a definite chemical composition with a certain physical properties or a substance that is naturally present in the earth and is not formed from animal or vegetable matter. In any country, the growth and development of industry depends on the availability and quality of deposits of minerals of economic importance. Mineral resources can be classified under three main types. They are metallic, nonmetallic and atomic minerals. Metallic minerals include native elements such as gold and silver ; haematite and magnetite (iron) ; Cuprite ( copper) ; Laterite ( aluminum) and non-metallic minerals include sand ( quartz ), garnet ; steatite (talc); muscovite ( mica ) whereas atomic minerals include Pitchblende (Uranium, Thorium ). The geological processes are caused for the formation of the minerals over million of years ago in the earth’s crust. Minerals are generally localized in occurrence and the deposits are very sporadic in distribution. Mineral resources are non renewable and the mineral /ore is extracted by the process of mining. Much risk is involved in mining process because of high temperature, pressure variations, fire hazards and lack of ventilation in mines. Minerals are used in a large number of ways for domestic, industrial, commercial sectors etc… Generation of energy by using coal ( lignite / anthracite ) ; uranium, gold, silver, platinum, diamond are used in jewellery. Copper, aluminum etc are used as cables for transmission of power. Some of the minerals are used in ayurvedam as medicine. Gold is reputed to strengthen the heart muscle and increase energy and stamina. By placing a piece of gold (devoid of stones) into 1000 ml of water and boiling it until reduced to 500 ml. Historical dose used gold ash of 10 mcg/day or gold water of 1 tsp 3x/day. Silver is a very important healing substance due to its cooling and antiseptic properties. It is most useful for treating Vata

and Pitta especially conditions involving weakness, and some of chronic fevers. It is also used for gastritis, inflammatory of the intestines. Historical dose used silver ash of 10-30 mcg/day or silver water of 1 tsp 3x/day. Copper was used to treat conditions of excess kapha (primarily) and vata (secondarily). Historical dose used: copper ash: 10-30 mcg/day or copper water: 1 tsp 3x/day

**Environmental effects:** Mineral extraction and processing in mines involves a negative impacton environment. Mining process involves removal of over burden of soil, ore extraction & transportation, crushing & grinding of ore, water treatment of ore, storage of waste material As a result of these activities cause air pollution, noise pollution, water pollution, loss of habitat of wildlife, concentration of toxic substances in tailing ponds and spreading of dust. People working in mines often suffer from serious respiratory system and skin diseases. Mining often causes ground subsidence which results in tilting of buildings, cracks in houses, buckling of roads, bending of rail tracks etc. Exploration process before a mining involves, geochemical, geophysical surveys drilling activities which causes for air pollution, noise pollution etc.. In addition, disturbance of all vegetation ( flora ) and fauna ( animals ) from that a region.

**Remedial measures**: Atmospheric pollution due to mining and associated activities can beminimized by planning and using dust extractors, by optimizing the blast design, maintenance of roads and sprinkling of water for easy movement of dumpers, by using eco generators ( sound proof ), proper maintenance of equipment and the machines not only minimize the air pollution but also the noise generation.

**case studies of mineral resources**

***1)Aravalli hills in Rajasthan***: The Aravallis hills spread across Haryana, Rajasthan and Gujaratand control the climate and drainage system of the region. Mining activity is being taken in this region due to immense mineral wealth ( Talc, marble, granite ).

Rajasthan state alone has 9700 industrial units connected with mining and 90% of forest has been depleted over the past 20 years. When the mining activity reached below the under ground water level, a cone of depression was formed in the surrounding areas and ultimately bore wells, dug wells, dried up and affected agriculture in a massive level. Several studies have pointed out that the natural drainage system and the ground water table of the entire region have been badly affected. Pollution levels have also increased. Lung diseases, silicosis were attacked by the laborers. In November 2002, the Supreme Court imposed a blanket ban on mining activities in the Aravalli hills. The court ruling closed all 9700 units. The environmentalists have alleged that mining has affected the water, forest and the land.

***2)Uranium mining in Nalgonda***: The Uranium Corporation of India proposed to mine Uraniumfrom the deposits of Lambapur and Peddagattu villages of Nalgonda dist. Processing unit was proposed at Mallapur village in Nalgonda dist by offering employment opportunities. But experts didn’t propose mining activity because of possible contamination of water. The proposed mines are just 1 km away from human habitation and 10 km from Nagarjuna sagar dam and 4 km away from Akkampalli reservoir, which is a source for drinking water.

3**) Gold mining in Europe**: Potassium Cyanide is used during the process of gold treatment. In 2000, the ***Baia Mare Gold mine*** in Romania ( Europe ), released 80 million litres of less concentrated cyanide into the Tisza river. The cyanide flowed 500 km via Hungary and Serbia cities caused for diseases.

4**) A** ***Gold and Copper project of Tedi Island in New Guinea*** released 1000 cubic meters of less concentrated cyanide into a river and affected the cultureand lifestyle of Guinea people.

**8. Give a brief account of Renewable energy resources.**

**A.** The important renewable energy resources are described below:

**Solar energy**: The energy which is derived from the sun is known as solar energy. It can be usedfor direct heating or sun’s heat is converted into electricity. Photo voltaic cells convert direct solar energy into electricity. A number of solar equipments have been developed to utilize sun rays to heat water, to cook food, to pump water and to run certain machines and used for street lighting, railway signals etc. But the major problem with solar energy is that during cloudy weather it is available in less quantity than on sunny days.

**Hydro-Power energy**: Electrical power is generated by hydro-electric projects in which damsare constructed across the river. The kinetic energy of water is converted into mechanical energy by means of turbines and in turn, the mechanical energy is transferred into electrical energy by generators. Hydro power projects lead to several environmental problems like destruction of animal habitats, deforestation , migration of people etc..

**Geothermal energy**: Geothermal energy found within rock formations. Inside the earth thetemperature rises with depth .The temperature in earth’s crust is around 4000oC. Geysers (a natural spring that emits hot water ) and hot springs are examples for geothermal energy where the steam and hot water come to the surface, in areas where the steam is tapped by drilling. The obtained steam is then used to generate power. Air pollution results in case of geothermal energy where the gases like H2S, NH3, CO2 present in the steam coming out of the geothermal sources. The overall efficiency for power production is low (15%) as compared to fossil fuels (40%). **Wind energy:** Wind energy is the kinetic energy associated with the movement of atmosphericair. Wind mills convert the wind energy into electrical energy. On an average wind mills can convert 30 – 40 % of available wind energy into electrical energy at a steady wind speed of 8.5 mts / sec. The efficiency of wind mill is increased with the speed of wind and length of rotor blade. The total wind energy potential in India’s estimate is 25,000 MW of this about 6000 MW is located in Tamil Nadu; 5000 MW in Gujarat and contribute the states of Andhra Pradesh, Maharashtra, Uttar Pradesh and Rajasthan for balance quantity.

**Merits & demerits of wind energy:**

1. It is a non – polluting and environment friendly source of energy.
2. It is a renewable energy available at free of cost
3. Power generation is cheaper with nil recurring expenses.

4.Wind mills are suitable to erect at on shore, remote and rural areas where wind blows with required intensity.

* Favorable in geographic locations which are away from cities.
* Wind turbine design, manufacturing, installation is complex due to varying atmospheric conditions.
* Wind power doesn’t suitable for large scale generation.

**Ocean energy**: Seas and oceans are large water bodies. Seas absorb solar radiation and a largeamount of solar energy is stored in the tides and waves of the ocean. Ocean energy is non – polluting in nature and suitable at a few places only. Energy from seas or oceans is obtained from the following:

(1) *Ocean Thermal Energy Conversion*: The oceans collect and store huge quantities of solar on the surface of the water while the temperature of deep waters is very low. Using this temperature difference it is possible to convert heat into electricity.

1. *Tidal energy*: Tidal waves of the sea can be used to turn turbine and generate electricity.Asia’s first tidal power plant of 800 - 1000 MW capacity is proposed to be set up at Kandla in Gulf of Kutch.
2. *Wave energy*: The wind blowing over water generates waves. A unique property of oceanwaves is their ability to travel vast oceanic distances with negligible loss of energy and ultimately arrives the continental margin of that basin. India’s first wave energy power plant of

150 KW capacity has been commissioned in Thiruvananthapuram, Tamil Nadu. 1 MW wave energy plant is being set up in Andaman and Nicobar islands.

1. *Current energy*: Theoretically, the ocean water used to generate energy by allowing the waterto pass through a series of turbines installed under water. The turbines are to be sealed and are kept at a depth of 10 to 20 mts. A propeller with a dia of 5 mts can generate about 150 MW of power.

**Bio mass energy**: Bio-mass is an organic material from living beings or its residues. It is arenewable source of energy derived from the waste of various human and natural activities. The bio-mass energy sources include Wood, animal manure, sugarcane waste, agriculture crops, house hold waste, roots of plants, garbage etc. The simplest way of using bio-mass energy sources is to allow them to dry out in the sun and burn them.

**Bio-gas**: Bio-gas is a sustainable source of energy by virtue of its production from available

natural organic wastes of cattle dung, human excreta, poultry waste, plant leaves, paddy husk etc…. Bio-gas is a mixture of methane (68%), CO2 (31%) and N2 (1%). Methane gas (CH4) is produced by bio-gas plants and this gas is utilized as cooking gas whose calorific value varies

from 4400 – 6200 Kilo Calories / cum. Heat value of bio gas can be improved by reducing its CO2 content. Bio-gas production is carried out in an enclosed bio-gas plant made of bricks or steel. Slurry of waste organic matter is fed into the plant through an inlet and gas formed is tapped by an inverted drum. As gas is produced the drum rises and the gas may be drawn through an outlet. Bio-gas is commonly produced from cattle dung in a bio gas plant known as Gobar Gas plant. Bio-gas is a clean, cheap fuel that can be used for lighting purpose, lifting water through small pumps.

1. **Give a brief account of Non- Renewable energy resources.**
2. **Non – renewable energy resources** include (a) fossil fuels such as coal, crude oil, natural gasand (b) nuclear energy.

**(a)Fossil fuels:** Fossil means the remains of an animal or a plant which have become hard andturned into rock. All these found in earth’s crust which has been formed in the past by the geological processes. Fossil fuels are solid coal (lignite), liquid (crude oil / petroleum) and gases (natural gas).

**Coal:** Huge quantity of plant materials buried under earth’s crust and altered by geologicalprocess and converted into carbon rich fuel. It is a non – renewable source because it takes a very long period (million of years) for its formation. Coal is extracted by the process of mining and

Involves accidents due to mine collapse, ground water pollution, accumulation of poisonous material, explosive gases etc cause diseases. CO2 pollution leads to green house effect (global

Warming).

**Crude oil:** It is obtained in the form of liquid. The crude oil is heated up to 600oC in the oilrefinery and condenses the vapors of hydro – carbons. Petrol and other petroleum products are refined fuels from crude oil. Petroleum products are used in large quantities in the manufacture of detergents, plastics, fertilizers, pharmaceuticals, synthetic rubber etc. The transport sector consumes about 40% of diesel; 25% industries and 19% household and rest 16% agriculture and other sectors. .

**Natural Gas:** Gas deposits are trapped from the sedimentary formations by means drilling holesinto the rock formations. While burning of natural gas, the emission of CO2 is less and thus reduces green house effect and global warming. A total of 734 billion cubic mts of gas is estimated as proven reserves.

**(b) Nuclear Energy or Atomic power:** It is the energy which is trapped inside the atom. It isnon–renewable source of energy which is released during fission or fusion of certain radioactive elements. The most important advantage of atomic power is the production of an enormous amount of energy from a small quantity of radioactive element. For eg: 1 kg of Uranium liberates energy equivalent to 30000 kgs of coal. Energy released during nuclear reaction (mass – energy equation as per Albert Einstein’s formula E = mc2). Nuclear Energy is produced by two

Processes namely

(1) Nuclear Fission (2) Nuclear Fusion.

**(1)Nuclear Fission**: The nucleus in atoms is split by fast moving neutrons and in turn atremendous amount of energy in the form of heat, light etc is released by a chain of reactions. Uranium is used as fuel. The energy released slowly in this process is utilized to generate electricity or else released suddenly all at once, results a tremendous explosion as in the case of Atom bomb.

**(2)Nuclear Fusion:** Nuclear energy can be generated by fusion process which involves twohydrogen atoms combine to produce one helium atom. Eg: hydrogen bomb, the disposal of nuclear wastes during mining, fuel production and reactor operation for a long time period resulting in adverse effects on environment. Disposable of nuclear waste is a national and global problem.

1. **Give a brief account on land resources?**

**A. Land Resources:**Land is the major part of the lithosphere. Land is made up of soils / rocks and are considered as very important resources of earth. Land plays a major role for growth of crops, vegetation, forests etc., Soils are formed due to disintegration of rocks by various physical processes like change in temperature, pressure, blowing wind and flow of water. The top layer of soil consists of mixtures of Humus (dead leaves & plants), some of the living organisms and Inorganic components which supply nutrients to the soil. Soil fertility depends on inorganic matter, organic matter, water, air and a variety of micro-organisms viz., bacteria, fungi, which help in the decomposition of organic matter and regeneration of nutrients.

**Distribution of land resources**

The utilization of land distribution in India as under:

|  |  |
| --- | --- |
| Agriculture land | 43.60 % |
| Pastures | 14.60 % |
| Waste lands but cultivable | 12.20 % |
| Forests | 10.70 % |
| Barren land | 8.40 % |
| Urban land | 5.30 % |
| Unavailable information on lands | 5.20 % |
| Total | 100.00 % |

**Types of Indian Soils**

Different types of soils are identified by taking into account the geographical extent, physical and chemical properties for the purpose of agriculture, nutritional factors.

* ***Alluvial soils***: This is generally alkaline and best soil for agricuture. Alluvial soils are derivedfrom debris brought by the floods or rivers or by tidal waves. Eg: North Indian Plains; Indo–

Gangetic Plain; Ganga and Brahmaputra Plains …

* ***Black soils***: Black soils are predominantly with clay and sandy loams. These soils are foundin the regions of AP ( Krishna and Tungabhadra basins) , Maharashtra ( Deccan Traps ) and Madhya Pradesh.
* ***Red soils***: The red colour is due to the presence of high proportion of iron component andcharacterized by low water retention capacity. Red soils are found in Andhra Pradesh, Tamil Nadu and parts of Bihar, Orissa and Western Ghats of Karnataka..
* ***Laterite soils***: These soils are rich in hydroxides of Ferrous and aluminum. At low elevationareas, the laterite soils are suitable for paddy cultivation whereas at higher elevations, they are suitable for coffee, tea, rubber etc., Western Ghats, Northern part of Eastern Ghats, North of Bangalore and West of Hyderabad are examples for laterite soils.
* ***Mountain soils***: These are stony. Mountain soils are formed due to dislodgement of rocks dueto landslides and occur over altitudes between 2000 to 3000 mts. Eg: Aravallis and East of Himalayas. Mountain soils are favour for growth of vegetation / forest .
* ***Desert soils***: These soils cover the parts of areas of Rajasthan and Kutch where the annualrainfall is less than 50 cms per annum.
* ***Saline soils***: Presence of salt and water retention make the soils unsuitable for agriculture.Eg: Arid ( no rain ) and Semi arid ( partly rain ) regions of northern plains and Maharashtra.

**Soil erosion and causes for soil erosion**

The top layer of the earth is called as soil. Soil erosion occurs due to deforestation, overgrazing,

industrialization; desertification etc.

**Deforestation:** Mining, industrial, urban development etc causes deforestation and leads toexposure of the land to wind and rains causing soil erosion. Cutting trees leads to deforestation which in turn loss of organic matter in the soils.

**Overgrazing**: When sufficient amount of grass is available for the organisms usually the entireland /area may be subjected to exhaust and the land is exposed without grass and ultimately the land expose to wind/rain causing soil erosion. .

**Industrialization**: Different processes carried out by industries and mining operations cause soilpollution which leads to degradation of land.

**Desertification**: The process of conversion of productive lands to unproductive lands is calleddesertification. This occurs due to loss of top layer of soil by erosion. Erosion of top layer results in loss of water holding capacity and finally converted in to unproductive areas .

***Land degradation and control of land degradation***

Land degradation can be defined as any change in the land that alter its conditions or reduces its quality. Land degradation occurs due to both natural disasters like volcanic eruptions, earthquakes, heavy rains, fire etc or human induced activities. The other causes of land degradation consists of wind blow, salinity of water, water logging, soil acidity, loss of flora and fauna. Desertification is land degradation occurring in the arid, semi-arid regions of the world.

These dry lands cover about 40% of the earth’s surface and puts at risk more than 1 billion people who are dependent on these lands for survival. Land clearing and deforestation; Mining activity in forest areas; urban conversion; bringing more land under cultivation; soil pollution ; loss of organic matter in the soils; alkalinization of soils; salinity of water etc leads to land degradation. Severe land degradation affects in decreasing the mineral wealth and economic development of nations. The methods that are followed for the prevention of land degradation are called soil conservation methods. Some of the popular methods are;

* ***Contour farming***: The land is prepared with alternate furrows (a long narrow cut in theground ) and ridges at the same level . The water is caught and held in furrows and stores which reduces run off and erosion.
* ***Mulching***: Stems of maize, cotton, tobacco etc are used as a mulch (decay of leaves) toreduce soil moisture, evaporation.
* ***Crop rotation***: Growing same crop year after year depletes the nutrients and land becomesunproductive. This is overcome by changing the crops and cultivating legumes (plants like peas, beans) after a regular crop.
* ***Strip cropping***: It consists of planting crops in rows or strips along contours to check flow ofwater.

**(e)*Agrostological methods****:* Korean grass, Mexican grasses are grown as erosion–resistingplants.

(f) ***Miscellaneous methods***: Construction of bunds, drains, widening of gullies, Afforestation methods prevent the soil erosion.

***Landslides and man induced land slides***

Landslides are always exist on this planet and the term land slide is used to describe a wide variety of process that result a downward movement of rocks under gravitational forces. In other words, mass movement of rocks, debris and soil down a slope of land. Landslides are primarily associated with steep slopes . Surface run-off and changes in drainage also cause for landslides. Landslides can also be initiated by rainfall; earthquakes; volcanic activity, changes in groundwater movement or any combination these factors. Debris-flows can travel down a hillside of speeds up to 200 miles per hour ( more commonly, 30 – 50 miles per hour) depending on the slope angle, water content, and type of earth and debris in the flow. While landslides are a naturally occurring environmental hazard they have recently increased in frequency in certain areas due to human activities. Building excavations, collapses in mining ( eg : coal mine) causes landslides. However, landslides can be triggered by the human beings by induced changes in the environment.

Simply landslides can be explained in three ways:

* Inherent of rocks (weakness in the structure of a rock )
* due to heavy seismic or volcanic activity and
* due to various environmental conditions.

**UNIT III**

**BIO DIVERSITY AND BIOTIC RESOURCES**

* + - 1. **OBJECTIVE TYPE QUESTIONS**

1. Wich of the following is not a biogeo graphic habitat of india as per classification
2. Himalyas B. westrn ghat C. sunderbans D. desert

2. Vinblastin and vincristine , two anticancer drugs have been obtained from

1. Periwrinkle B. cimchona C. bacterium D. jelly fish

3. Western ghats are very rich in endemic species of

1. Birds B. lions C. amphibians D. turtles

4. Which of the following hot spots of biodiversity has the maximum number of plant and vertebrate species.

A. Caribbean B. tropical andes C. Madagascar D. indo Burma

5. Which of the following is an extinct species

A. dugong B. great Indian bustard C. dodo D. red panda

6. which of the following is an example of ex situ conservation

A. biosphere reserve B. gene bank . C. sanctuary D. all of above

7. kaziranga national park is famous for

A. one horned rhino B. hangul C. tiger D. elephant

8. there only two sanctuaries in india dealing with preservation of plants the plants are

A. mango – orchid B. citrus – pitcher plant C. mango – citrus D. mango - pitcher plant

9. cryopreservation of plant seeds and pollen is done at a very low temp. of -1960C by using

A. ice B. carbon tetrachloride C. liquid nitrogen D. ammonia

10. which one of the following national parks do not have tigers as their main wild life

A. gir B. Corbett c. dudva D. ranthambore

11.How many bio-geographical regions are present in India?( Ans. D)

|  |  |
| --- | --- |
| A | 3 |
| B | 4 |
| C | 7 |
| D | 10 |

|  |
| --- |
|  |

12.Lime is added to the soil which is too( Ans. D)

|  |  |
| --- | --- |
| A | Sandy |
| B | Salty |
| C | Alkaline |
| D | Acidic |

|  |
| --- |
|  |

13.Which one of the following has maximum genetic diversity in India? ( Ans. C)

|  |  |
| --- | --- |
| A | Tea |
| B | Teak |
| C | Mango |
| D | Wheat |

|  |
| --- |
|  |

14.Which one of the following areas in India, is a hotspot of biodiversity? ( Ans. B)

|  |  |
| --- | --- |
| A | Sunderbans |
| B | Western Ghats |
| C | Eastern Ghats |
| D | Gangetic Plain |

|  |
| --- |
|  |

15.Darwin’s finches are a good example of( Ans. D)

|  |  |
| --- | --- |
| A | Convergent evolution |
| B | Industrial melanism |
| C | Connecting link |
| D | Adaptive radiation |

|  |
| --- |
|  |

16.The least porous soil among the following is a( Ans. C)

|  |  |
| --- | --- |
| A | Loamy soil |
| B | Silty soil |
| C | Clayey soil |
| D | Peaty soil |

|  |
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|  |

17.Which one of the following is not a renewable, exhaustible natural resource? ( Ans. D)

|  |  |
| --- | --- |
| A | Aquatic animals |
| B | Wild life |
| C | Soil fertility |
| D | Minerals |

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| --- |
|  |

18.Which one of the following is an example ex-situ conservation? ( Ans.C)

|  |  |
| --- | --- |
| 18A | National park |
| B | Wildlife sanctuary |
| C | Seed bank |
| D | Sacred groves |

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19.Which one of the following is not observed in biodiversity hotspots? ( Ans. D)

|  |  |
| --- | --- |
| 19.A | Species richness |
| B | Endemism |
| C | Accelerated species loss |
| D | Lesser inter-specific competition |

|  |
| --- |
|  |

20.Sacred groves are specially useful in( Ans. D)

|  |  |
| --- | --- |
| A | Generating environmental awareness |
| B | Preventing soil erosion |
| C | Year-round flow of water in rivers |
| D | Conserving rare and threatened species |

|  |
| --- |
|  |

21. The term Alpha diversity refers to( Ans.B)

|  |  |
| --- | --- |
| A | Genetic diversity |
| B | Community and ecosystem diversity |
| C | Species diversity |
| D | Diversity among the plants |

|  |
| --- |
|  |

22.The percentage of forest cover recommended by the National Forest policy (1988) is( Ans. A)

|  |  |
| --- | --- |
| A | 33% for plains and 67% for hills |
| B | 37% for plains and 63% for hills |
| C | 20% for plains and 70% for hills |
| D | 23% for plains and 77% for hills |

|  |
| --- |
|  |

23.Select the correct statement about biodiversity( Ans. C)

|  |  |
| --- | --- |
| A | The desert areas of Rajasthan and Gujarat have a very high level of desert animal species as well as numerous rare animals |
| B | Large scale planting of BT cotton has no adverse effect on biodiversity |
| C | Western Ghats have a very high degree of species richness and endemism |
| D | Conservation of biodiversity in just a fad pursued by the developed countries |

|  |
| --- |
|  |

24. Biodiversity of a geographical region represents( Ans. D)

|  |  |
| --- | --- |
| A | Genetic diversity present in the dominant species of the region |
| B | Species endemic to the region |
| C | Endangered species found in the region |
| D | The diversity in the organisms living in the region |

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| --- |
|  |

25.Global warming can be controlled by **[NEET 2013]** ( Ans. A)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| A | | Reducing deforestation, cutting down use of fossil fuel | | | | |
| B | | Reducing reforestation, increasing the use of fossil fuel | | | | |
| C | | Increasing deforestation, slowing down the growth of human population | | | | |
| D | | Increasing deforestation, reducing efficiency of energy usage | | | | |
| **26** | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif \_\_\_\_\_\_\_\_\_ is a new branch of science that studies all aspects of biodiversity with the goal of conserving natural resources. | | |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **A)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | Human biology |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **B)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | Conservation biology |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **C)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | Agronomy |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **D)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | Wildlife management |
| http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | | | | | |
| http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | | | | | |
| **27** | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif What ethical principle is supported by conservation biology? | | |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **A)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | biodiversity is desirable for all living things, including humans |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **B)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | extinctions due to human actions are undesirable |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **C)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | biodiversity has value unto itself |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **D)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | All of these are correct. |
| http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | | | | | |
| http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | | | | | |
| **28** | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif What percentage of all living species will go extinct within the next 20 to 50 years from human activities if steps are not taken to conserve species? | | |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **A)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | 1-2% |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **B)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | 5-10% |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **C)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | 10-20% |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **D)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | 50-75% |
| http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | | | | | |
| http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | | | | | |
| **29** | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif Why is genetic diversity within a population important? | | |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **A)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | so the population is less susceptible to disease |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **B)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | so individuals of the population can survive when the environment changes |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **C)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | so museums can have more realistic collections |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **D)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | Both A and B are correct. |
| http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | | | | | |
| http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | | | | | |
| **30** | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif Habitats with usually high numbers of species are referred to as \_\_\_\_\_\_\_. | | |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **A)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | heterogenous |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **B)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | divergent |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **C)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | biodiversity hotspots |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **D)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | multiform |
| http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | | | | | |
| http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | | | | | |
| **31** | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif Why is biodiversity valuable and desirable to humans? | | |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **A)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | for medicinal purposes |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **B)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | for agricultural diversity |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **C)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | for consumptive use |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **D)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | All of these are correct. |
| http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | | | | | |
| http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | | | | | |
| **32** | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif Which of these is not an indirect value of biodiversity? | | |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **A)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | runoff from natural ecosystems pollutes sources of fresh water |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **B)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | regulation of the climate |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **C)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | prevention of soil erosion |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **D)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | participation in biogeochemical cycles |
| http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | | | | | |
| http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | | | | | |
| **33** | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif What activity does not constitute habitat loss? | | |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **A)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | highway construction |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **B)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | forest fragmentation as new towns are built |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **C)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | converting wetland into housing areas |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **D)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | None of these is correct. |
| http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | | | | | |
| http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | | | | | |
| **34** | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif What percentage of coral reefs have already been destroyed? | | |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **A)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | 10% |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **B)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | 25% |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **C)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | 60% |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **D)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | 100% |
| http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | | | | | |
| http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | | | | | |
| **35** | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif Humans have introduced alien species into the environment in all these ways except \_\_\_\_\_\_\_\_\_. | | |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **A)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | genetic engineering |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **B)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | human colonization of new areas |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **C)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | horticulture and agriculture |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **D)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | accidental transport |
| http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | | | | | |
| http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | | | | | |
| **36** | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif What statement is true about pollution? | | |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **A)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | pollution is any environmental change that adversely affects living things |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **B)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | pollution is the third main cause of extinction |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **C)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | pollution can lead to disease |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **D)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | All of these are true about pollution. |
| http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | | | | | |
| http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | | | | | |
| **37** | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif Eutrophication is caused by runoff containing nutrients that does what to kill fish in a lake? | | |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **A)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | algae overproduce and die; bacteria use up all the oxygen so fish die |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **B)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | algae overproduce and crowd out fish and other species |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **C)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | fish overproduce and eat all possible sources of food then starve |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **D)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | algae overproduce oxygen, which is toxic to fish in high quantities |
| http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | | | | | |
| http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | | | | | |
| **38** | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif What organism is near extinction due to overexploitation? | | |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **A)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | exotic pets |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **B)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | rare cacti |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **C)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | Siberian tiger |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **D)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | All of these are correct. |
| http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | | | | | |
| http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | | | | | |
| **39** | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif Extinction of the \_\_\_\_\_\_\_\_\_ of a community could lead to the extinction of other members of the community. | | |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **A)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | decomposers |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **B)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | primary consumers |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **C)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | keystone species |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **D)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | numerically dominant species |
| http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | | | | | |
| http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | | | | | |
| **40** | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif A \_\_\_\_\_\_\_\_\_ is a population divided into smaller groups by habitat fragmentation. | | |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **A)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | source population |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **B)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | keystone population |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **C)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | metapopulation |
|  | | | http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | **D)**http://highered.mheducation.com/olcweb/styles/shared/spacer.gif | sink population |

* 1. **SHORT ANSWER TYPE QUESTIONS**

1. What is meant by species diversity?

Ans: The number of different species (plant and animals species) present in a community or a given area of an ecosystem.

. 2. What is meant by Genetic Diversity?

Ans: Variations in the genetic characteristics among individuals within a species Ex: Human beings have different colours, capabilities, qualities etc.

3. Ecosystem Biodiversity?

Ans: Ecosystem biodiversity refers to change in biodiversity from area to area, state to state, country to country.

4. Define Bio-diversity?

Ans: It refers to variability among all groups of living organisms.

5. Consumptive –use values?

Ans: These are also called as non-market values. People directly go to forest to take their needs.

6. Productive –use values?

Ans: These are also called as market values. People go to market to buy their needs.

7. Ethical Values?

Ans: Respecting all forms of life is called as Ethical values.

8. Aesthetic values?

Ans: Getting inspired by the nature to write poems, songs, stories etc.

9. Define Hotspots?

Ans: An area which consists of rich species are termed as Hotspots. In India Hotspots are seen in Western Ghats and Eastern Himalayas.

10. Expand IUCN?

Ans: International Union for Conservation of Nature and Natural resources. It publishes the book called **Red Data Book** which includes the list of endangered species.

11. What are Extinct species?

Ans: A species is said to be extinct when it is not seen in the wild (Parent)for 50 years.Ex:Dodo,Passenger pigeon.

12. What are endangered species?

Ans:A species is said to be endangered when its number has been reduced to a critical levels and if such species is not protected or conserved it will be extinct(completely disappear).

13. What are Vulnerable species?

Ans: A species is said to be vulnerable if its population facing continuous decline.

14. What are Rare species?

Ans: Species which are not endangered or Vulnerable at present, but are at risk if not protected are termed as Rare species.

15.In-situ conservation?

Ans: It refers to protecting the plants and wildlife in their natural habitats only.Ex:Bio-sphere reserves ,National parks, Sanctuaries.

16. What is Ex-situ conservation?

Ans:It refers to protecting the plants and wildlife outside their natural habitat (artificial conditions).Ex: Zoo,Gene bank/seed banks etc.

17. Write about Cryopreservation?

Ans: Cryopreservation is a technique where we use liquid nitrogen (-196 c) to preserve the tissues etc.

18. Write about NBPGR?

Ans: It stand for National Bureau of Plant Genetic Resources. It is located in New Delhi. Here agricultural and Horticultural crops are preserved.

19. Write about NBAGR?

Ans: It stands for National Bureau of Animal Genetic resources. It is located in Karnal,Haryana. It is used to store genetic material (DNA) of animals etc.

20. Write about NFPTCR?

Ans: It stands for National Facility for Plant Tissues Culture Repository. It protects /preserves plants by tissues culture methods.

21. Poaching?

Ans:Poaching is otherwise called as Illegal hunting.

22. National bio-diversity Act?

Ans: It was passed in the year 2002. The main aim is to protect the species present with in India.

23. How many Bio-geographical does India has?

Ans: India has 10 Bio-geographical zones. There are as follows:Trans –Himalyas,Himalyas,Gangeticplains, The north eastern zone,Desert,semi-arid zones, Western Ghats, Deccan plateau, The coastal Islands.

24. who coined the term hotspots?

ans: Norman myers in 1988 coined the term hotspots.

note: be thorough with list of national parks and wild life sanctuaries.

* + - 1. **ESSAY TYPE QUESTIONS**

1. **DEFINE BIODIVERSITY. EXPLAIN GENETIC, SPECIES ANF ECOSYSTEM DIVERSITY**

**Ans:** The word biodiversity is a combination of two words: “biological and diversity” and refers to the variety of life on the Earth which includes a large number of living things that exist in a certain area (in the air, on land or in water). The area may be considered as small as heap or as big as whole planet. Hence, Biodiversity means **“the** **existence of a large number of different kinds** **of animals and plants which make a balanced environment”** is called as biodiversity.Biodiversity deals with a large variety of flora and fauna on this earth.

***Ex:*** a wide variety of plants and animals are finding in a part of forest. The plant life range froma small herb to a large tree and the animal life vary from a tiny insect to a large mammal in addition to micro-organisms (algae, bacteria and fungi).

**Biodiversity is usually considered at three different levels:**

1. **Genetic diversity** means the variation of genes within the species.

***Ex:*** In human species, genetic variation between an Indian and African and genetic variationswithin a population. (Ex: Within the Indian population) can be seen. In simple terms, genetic matter dictates whether the persons have blue or brown eyes, brown or black hair and tall or short. Genetic diversity can be identified by using a variety of DNA based and other techniques.

One estimate is that there are 1000 crores of different genes distributed across the worlds biota though they do not all make an identical contribution to overall genetic diversity.

1. **Species diversity** means the richness of species in all ecosystems. It is measured on the basisof number of species in a region. So far 1.75 million species have been described worldwide. Warmer areas tend to support more species than colder ones and wetter areas contain more species than drier ones. Topography and climate of the areas support and control the species of a region.
2. **Ecosystem diversity** means the study of difference between ecosystem types. Ecosystemdiversity is difficult to measure since the boundaries of various sub ecosystems are overlap each other. ***Ex:*** for ecosystem diversity is Godavari – Delta ecosystem which consists of grassland ecosystem, river ecosystem, estuarine ecosystem, fresh water aquatic ecosystem, marine water aquatic ecosystem.
3. **Define bio diversity and explain its values.**

**Value of biodiversity:** The value of biodiversity (in terms of its commercial utility, ecologicalservices, social and aesthetic values) is enormous. There are several ways that biodiversity and its various forms are valuable to humans. We get benefits from organisms in an innumerable ways. Sometimes, one realizes the value of the organism only after it is lost from this Earth. Every year numerous species are lost before we have a chance to know anything about them.

**The biodiversity value may be classified as follows:**

* **Consumptive Value*:*** Biodiversity is an essential requirement for the maintenance of globalfood supply. The main sources of human food include animals, fish and plant produces. A large number of plants are consumed by human beings as food. A few animal species are consumed by people who come from cattle, pigs, sheep, goats, buffaloes, chickens, ducks, geese and turkey species.

**Fish:** Many fresh water fish can be grown in ponds. Israel and China already get about half oftheir fish from aqua culture.

**Drugs & medicines:** About 75% of the world’s population depends upon plants orplant extractsfor medicines. The drug Penicillin used as an antibiotic is derived from a fungus called Penicillium. Likewise, Tetracycline from bacteria which is used to cure malaria is obtained from the bark of cinchona tree.

**Fuel:** The fossil fuels like coal, petroleum products and natural gas are the products ofbiodiversity.

* **Productive Value:** Some of the organisms are commercially usable where the product ismarketed and sold. The animal products like tusks of elephants; musk from deer, silk fromsilkworm, wool from sheep or goats; fur of many animals etc all of which are traded in the market.

→ **Calabar bean** was tradionally used as a poison in West Africa*.*

→**Daisy plants** were first used as a lice remedy in the Middle East and this led to the discovery of **Pyrethrum**. Mosquito coils made from Pyrethrum are sold in the market.

* The bacterium **Bacillus thuringiensis** produces toxic proteins that kill certain insects.
* The **neem** *tree* has been using in birth control such as parts of neem tree that cause abortion.
* **Social Value**: These are the values associated with the social life, religion and spiritual aspectsof the people. Many of the plants are considered to be sacred in our country like Tulasi, Mango leaves, Banana leaves. The leaves, fruits, flowers of some of the plants are used in worship. Many animals like cow, snake, bull, peacock also have significant place in spiritual and thus hold special importance. Thus, biodiversity has distinct social value, attached with different societies.
* **Ethical Value**: The ethical value means that human beings may or may not use a certainspecies but knowing the very fact that this species exists in nature gives pleasure.

***Ex:*** a peculiar species of Pigeon, grey / white bird with short legs is no more on this earth.Similarly, Dodo species is also no more. Human beings are not deriving anything direct from Kangaroo, giraffe but strongly feel that these species should exist in nature.

**Aesthetic Value**: Every one of us would like to visit vast stretches of lands to enjoy the visiblelife. People from farther areas, spend a lot of time and money to visit wild life areas where they can enjoy the aesthetic value of biodiversity and this type of tourism is known as eco tourism. Eco-tourism is estimated to generate 12 billion dollars of revenue annually that roughly gives the aesthetic value of biodiversity. A study of the impact of environment on the psyche was undertaken by Kaplan and Kaplan (1989) in whom they found that being near nature relieved working stresses while people who worked in closed environment or human made structures experienced much more job stresses and illnesses

**.3. Explain India as a mega diversity nation**

**Ans: India a s mega diversity nation:**

* India is one of the 12 mega diversity countries in the world.
* The ministry of environment and Forests,records show 47,000 plant species and 89,000 animal species.
* A large proportion of the India Biodiversity is still unexplored
* Due to diverse climatic conditions there is a complete rainbow spectrum of biodiversity in our country.

Reasons for India as a mega- diversity nation

1. **Endemism:**

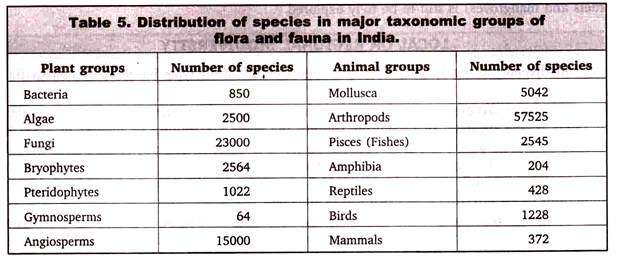
* Species which are restricted only to a particular area are known as endemic species
* India shows a good number of endemic species. About 62% amphibians , 50% lizards, 53% fresh water fishes 36% reptiles 10% mammals and 33% flowering plants are endemic to India.
* Western Ghats are the site of maximum endemism.

1. **center of origin:**

* A large number of species are known to have originated in India.
* Nearly 5000 species of flowering plants had their origin in India . from agro –diversity point of view also our country is quite rich .
* India has been the center of origin of 166 species of crop plants and 320 species of wild relatives of cultivated crops, thereby providing a broad spectrum of diversity of traits for our crop plants.

**3. Marine diversity:**

* The coastline of our country exhibits a rich biodiversity
* Along 7500km long coastline,in the mangroves,coral reefs back waters etc,different species are found.
* The marine diversity is rich in Mollusks, Crustaceans and several species of Mangrove plants and sea grasses are found.



**4.What are hot spots of bio diversity which hot spots are found in India Discuss their salient features?**

**Hotspots of bio diversity:**

Areas which exhibit high species richness as well as high species endemism are termed as hotspots of biodiversity.

The term introduced by Myers (1988) . Earlier 25 such hot spots of biodiversity were identified on a global level out of which two were present in India . later 9 hot spots were added bringing the total to 34

* These hot spots covering less than 2% of the world’s land area are found to have about 50% of the terrestrial biodiversity. According to Myers an area is designed as a hotspots when it contains at least 0.5% or 1500 species of the plant species as endemics and have lost at least 70% of its primary vegetation.
* About 40% of terrestrial plants and 25 % of vertebrate species are endemic and found in these hot spots.
* After the tropical rain forests , the second highest number of endemic plant species are found in the Mediterranean
* Broadly, these hot spots are in Western Amazon, Madagascar, North and east Borneo, North – eastern Australia, West Africa and Brazilian Atlantic forests.
* These are the areas of high diversity, endemism and are also threatened by human activities . more than 1 billion people ,most of whom are desperately poor people, live in these areas.
* Any measures of protecting these hot spots need to be planned keeping in view the human settlements and tribal issues.



**EASTERN HIMALAYAS HOTSPOT :**

* The Eastern Himalayas is the region encompassing Bhutan, northeastern India, and southern, central, and eastern Nepal.
* It has nearly 163 globally threatened species including Asia's .
* Largest Herbivores: the One-horned Rhinoceros,

the Wild Asian Water Buffalo,

Asian elephant.

* Carnivores: Tiger
* Birds: Vultures, Storks and Horn bills
* Out of the worlds recorded flora 30% are endemic to India of which 35000 are in the Himalayas.

**WESTERN GHATS HOTSPOT:**

* Extends along 17000 Km² strip of forests in Maharashtra ,

Karnataka, Tamil Nadu ,Kerala .

* It has 40% of endemic plant species.
* About 62% amphibians ands 50% lizards are endemic to

Western Ghats.

* Much of the world's spices such as Black pepper and Cardamom have their origins in the Western Ghats.
* The highest concentration of species in the Western Ghats is believed to be the Agastyamalai Hills and Silent Valley –The New Amambalam Reserve Basin in the extreme south.

**INDO-BURMA:**

***About the region:*** The Indo-Burma region encompasses several countries. It is spread out from Eastern [Bangladesh](http://en.wikipedia.org/wiki/Bangladesh) to [Malaysia](http://en.wikipedia.org/wiki/Malaysia) and includes North-Eastern India south of Brahmaputra river, Myanmar, the southern part of China's Yunnan province, Lao People’s Democratic Republic, [Cambodia](http://en.wikipedia.org/wiki/Cambodia), Vietnam and [Thailand](http://en.wikipedia.org/wiki/Thailand). The Indo-Burma region is spread over 2 million sq. km of tropical Asia. Since this hotspot is spread over such a large area and across several major landforms, there is a wide diversity of climate and habitat patterns in this region.

***Biodiversity:*** Much of this region is still a wilderness, but has been deteriorating rapidly in the past few decades. In recent times, six species of large mammals have been discovered here: Large-antlered muntjac, Annamite muntjac, Grey-shanked douc, Annamite striped rabbit, Leaf deer, and the [Saola](http://en.wikipedia.org/wiki/Saola" \o "w:Saola). This region is home to several [primate](http://en.wikipedia.org/wiki/primates) species such as monkeys , langurs and gibbons with populations numbering only in the hundreds. Many of the species, especially some freshwater turtle species, are endemic. Almost 1,300 bird species exist in this region including the threatened white-eared night-heron, the grey-crowned crocias, and the orange-necked partridge. It is estimated that there are about 13,500 plant species in this hotspot, with over half of them endemic. [Ginger](http://www.biodiversityofindia.org/index.php?title=Ginger), for example, is native to this region.

**5 .WHAT ARE THE MAJOR THREARS TO BIODIVERSITY.**

**ANS:** Some of the major threats to Biodiversity:

* Habitat related (Loss, Degradation, Fragmentation)
* Poaching
* Pollution
* Over exploitation
* Invasive species
* Anthropogenic climate change
* Disease(Lesser threat to Most taxa)
* UV radiation (Primary threat to amphibians)

** Habitat fragmentation:**

Loss of Habitat in installments- Habitat Fragmentation.

Bears and large cats that require large territories to subsist are threatened badly (breed in interiors)

Marine diversity-large scale destruction of fragile breeding and feeding grounds of our oceanic fish and other species due to human intervention.,

**Poaching** :

* illegal trading of wildlife products from endangered animals i.e., poaching is another threat to wildlife.
* Despite international ban on trade in products from endangered species, smuggling of wildlife items like Furs,hides,Horns,tusks,live specimens and herbal products worth millions of dollars per year continues.
* Asia, Latin America and Africa - richest source of Biodiversity and enormous wealth of wildlife.
* For every animal gets into market , about 50 additional animals are caught and killed. 

**Pollution:** The discharge of toxic synthetic chemicals and heavy metals into the environment has a huge impact on species abundance, and can lead to extinctions.

* It’s important to remember that substances that are “natural” can become pollution when they are too abundant in a certain area.
* For example, nitrogen and phosphorous are important nutrients for plant growth, but when they concentrate in water systems after being applied as agricultural fertilizers, they can cause “dead zones” that are uninhabitable for fish and other wildlife.
* Also, carbon dioxide is a “natural” component of the atmosphere, but is considered a pollutant when emitted by human industrial activities.
* *Bioaccumulation* is an important concept connected with pollution. This is the process of chemicals becoming increasingly concentrated in animal tissues as they move up the food chain.

**Climate change** is one of the biggest threats to biodiversity on a long-term scale. Carbon emissions caused by human activity are causing temperature changes that affect ecosystems and so impact upon animal and plant species.

* It is causing some animal populations to migrate to areas they would not normally inhabit, with the potential to upset those systems, while also directly causing numbers to decline.
* Consider the polar bear. Rising temperatures mean that the pack ice on which they hunt has begun to break up much earlier in the year than previously.
* This means they do not have enough time to build up the fat reserves that will see them through the winter. Polar bears are now an endangered species
* Climate change is also causing more unpredictable extreme weather events, such as tsunamis and droughts, which affect biodiversity and the ability of ecosystems to regenerate.
* It is also affecting where humans are able to grow crops, which will also have an impact on native plants and animals, with the attendant problems due to habitat loss, pollution and over exploitation

**Invasive Species**

* When an animal, plant, or microbe moves into a new area, it can affect the resident species in several different ways.
* New species can parasitize or predate upon residents, hybridize with them, compete with them for food, bring unfamiliar diseases, modify habitats, or disrupt important interactions.
* One famous and striking example of an invasive species is the brown tree snake in Guam. Native to Australia, the snake was accidentally transported to Guam in ship cargo following World War II. Because Guam had basically no predators to keep the snake population in check, it rapidly multiplied and caused the extirpation of most of the resident bird species.
* *Extirpation* means extinction within a region: the species survives elsewhere, but not in that region.

**Over Exploitation:**

* A more direct threat to animal and plant numbers is the overexploitation of the natural world by humans.
* Not only does this impact upon population of targeted species, the removal of certain animals or plants can unbalance ecosystems, leading to further problems.
* An example would be the over hunting of seas turtles for their meat and shells.
* Not only are sea turtle numbers very small, hunting them has removed the primary predator of jellyfish from ocean ecosystems. The jellyfish population explodes causing populations of other fish species to decline as they out-compete with them for nutrients in the water.
* Exploitation of the earth includes everything from cutting down trees for timber, and catching fish for food to hunting animals for their skins or to sell as pets.

**6. WHAT ARE THE MAJOR CAUSES OF MAN – WILDLIFE MCONFLICTS? DISCUSS THE REMEDIAL STEPS THAT CAN CURB THE CONFLICT.**

* Human–wildlife conflict
* **Human–wildlife conflict** refers to the interaction between [wild animals](https://en.wikipedia.org/wiki/Wild_animals) and people and the resultant negative impact on people or their resources, or wild animals or their habitat. It occurs when growing human populations overlap with established wildlife territory, creating reduction of resources or life to some people and/or wild animals. The conflict takes many forms ranging from loss of life or injury to humans, and animals both wild and domesticated, to competition for scarce resources to loss and [degradation of habitat](https://en.wikipedia.org/wiki/Habitat_degradation).
* Most of the Tiger attacks in India appeared in the Sundarbans mangrove forest National Park of West Bengal. Sundarbans host largest population of tigers in the world due to its densely covered mangrove forests and climate. In the recent tiger attacks on Human was, A tiger attacked forest rangers on an Elephant in the Kaziranga National Park of Assam, in the north-east state of India. The tigers are known as [Man-Eaters and Sundarbans](http://www.walkthroughindia.com/wildlife/the-deadly-human-wildlife-conflict-in-india-people-and-wildlife/www.walkthroughindia.com/wildlife/india-history-man-eating-tigers/) is one of the famous place to spot these big cats, there are only [1706 tigers are left in the wild India.](http://www.walkthroughindia.com/wildlife/the-deadly-human-wildlife-conflict-in-india-people-and-wildlife/The%20Endangered%20Royal%20Bengal%20Tiger-%20Only%201,706%20Tigers%20Left%20in%20the%20Wild%20India)
* Leopard attacks on humans are regularly reported only in India,The Panthera pardus or the leopards kill more humans in India than all other carnivores. Human–leopard conflict regions of the country are West Bengal, Maharashtra and Assam where most of the deadly leopard attack incident happened.
* Elephant is one of the holy animal in India,especially in Kerala but due to elephant attack some 500 people are killed by each year. There are many incident of elephant attacks occurred in the villages of Kerala and other parts of India.
* A sloth bear attacked and killed one person and seriously injured three others in India,major zone includes Madhya Pradesh and Chhattisgarh where most of the incident occurred.
* **Jim Corbett National Park :** The Corbett National Park of Uttarakhand is famous for notable man-eaters leopard, responsible for at least 400 attacks on humans. Leopard of Panar,Leopard of Rudraprayag and Leopard of the Mulher Valley have claimed thousand of human and cattle lives. Leopards are still one of the most dangerous animal in India and responsible for many human life alone among the other four big cats of India.
* Sundarbans National Park

The largest Swamp and mangroves forest of India is also home to over 500 Bengal tigers, who killed from 50-250 people per year in India and Bangladesh. Tiger attacks in the Sundarbans is the best example of human interaction and conflict between local people and wild animals. The Man-Eating Tigers of Sundarbans and Human wildlife Conflict rate has dropped significantly due to better management techniques.

**CAUSES FOR HUMAN – WILD LIFE CONFLICTS:**

1. Dwindling habitats : tigers , elephants, rhinos and bears suffer due to shrinking forest cover Which compels them to move out side the forest and attack the field or sometimes even humans.

ii) Man –eating tendency; usually the ill , weak and injured animals have to attack man.

Also the female tigress attaks the human if she feels that her new born cubs are in danger. But the biggest problem is that if human – flesh is tasted once then the tiger does not eat any other animal. At the same time , it is difficult to trace and cull the man eating tiger and in the process many innocent tigers are killed .

Iii) Scarcity of food :- this is a major cause of earlier , forest departments used to cultivate

paddy, sugarcane etc. within the sanctuaries when the favourite staple food of elephant i.e., Bamboo leaves were not available. Now due to lack of such practices the animals move out of The forest in search of food.

iv) Electric wiring : put by every often the villages put electric wiring around their ripe crop Fields. The elephants get injured, suffer in pain and turn violent.

v) Lack of corridors :- earlier there used to be wild life corridors through which the wild

animals used to migrate seasonally in groups to other areas. Due to development of human settlements in these corridors , the path of wild life has been disrupted and the animals attack the settlements.

vi) Inadequate compensation: the cash compensation paid by the government in lieu of the damage caused to the farmers crop is not enough . In mysore, a farmer gets a compensation of Rs/- 400per quintal of expected yield while the market price is Rs/- 2400 per quintal.The agonized farmer therefore gets revengeful and kills the wild animals.

REMEDIAL MEASURES TO CURB THE CONFLICT:

1. Tiger conversation project; this has made provisions for making available vehicles, tranquillizer guns , binoculers and radio sets etc. to tactfully deal with any imminent danger
2. Adequate crop compensation and cattle compensation scheme must be started, along with substantial cash compensation for loss of human life.
3. Solar powered fencing ; should be provided with electric current proof trenches to prevent the animals from straying into fields.
4. Cropping pattern ; should be changed near the forest borders and adequate fodder, fruit and water should be made available for the elephants within forest zones,,
5. Wild life cprridors; should be provided for mass migration of big animals during unfavourable periods. About 300km2 area is required for elephant corridors for their seasonal migration.
6. In similipal sanctuary , Odisha there is a ritual of wild animal hunting during the months of April – may for which forest is burnt to flush out the animals . due to massive hunting by people , there is a decline in prey of tigers and they start coming out of the forest in search of prey .

**7. WHAT IS MEANT BY IN- SITU AND EX SITU - CONVERSATION OF BIODIVERSITY? GIVE EXAMPLES.**

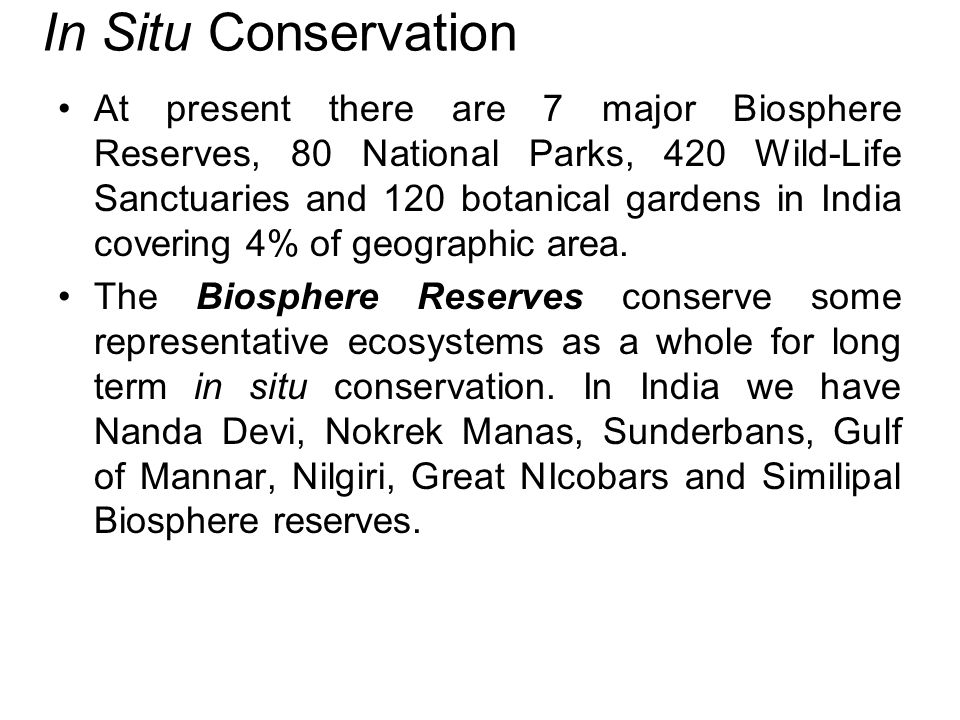
It is two types

1. In situ – conservation : (within the habitat) this is achieved by protection of wild flora and fauna in nature itself . E.g.; biosphere reserves, national parks , sanctuaries reserve

Forests etc.

2. Ex situ conversation ; (out side ) : this is done by establishment of gene banks, seed

banks , zoos, botanical gardens , culture collections.

I

in-situ conservation involves protection of a group of typical ecosystems through a network of protected areas like biosphere reserves, national parks, sanctuaries, sacred lakes and reserve forests.

**(i) Biosphere Reserves:**

Biosphere reserves conserve some representative ecosystems containing unique biological communities. They also ensure conservation of landscapes, species and genetic resources. At present, India has 13 Biosphere reserves viz. Nanda devi (UP), Nokrek (Meghalaya), Manas (Assam), Sunderbans (West Bengal), Gulf of Mannar (Tamil Nadu), Nilgiri (Karnataka, Kerala, Tamil Nadu), Great Nicobars and Similipal (Orissa), Dibru saikhowa, Dehan debang, Pachmarhi, Agasthyamalai and Khanghendzonga.

**(ii) Protected areas (National parks and sanctuaries):**

Protected areas of land or sea are specially dedicated to the protection of biodiversity and associated cultural resources. The World Conservation Monitoring Centre (WCMC) has recognised 37000 protected areas around the world. As on September 2002, India had 581 protected areas (89 National parks and 492 wildlife sanctuaries).

**National Parks:**

A national park is an area which is strictly reserved for the welfare of wildlife and where activities such as forestry, grazing, cultivation, habitat manipulation and private rights are prohibited.

**Major national parks with important wildlife are listed in Table 7:**



**Wildlife Sanctuaries:** Sanctuaries are protected areas where killing, hunting, shooting or capturing of wildlife are prohibited. However, private ownership rights and forestry operations are permitted to the extent that they do not affect wildlife adversely.

**Gene Pool:** Gene pool is defined as the total number of genes of every individual in an interbreeding population possessed by a specific species at a particular time. A large gene pool indicates high genetic diversity, increased chances of biological fitness and survival. A small gene pool shows low genetic diversity, reduced chances of acquiring fitness and increased possibility of extinction. Gene pool increases when mutation occurs and survives. It decreases when population size is significantly reduced by genetic diseases and deformities.

**Significance:** Gene pool gives an idea of the number of varieties and types of genes existing in a population. It can be used to determine gene frequencies or the ratio between different types of genes in a population.

**Gene sanctuary:** For plants, there is one gene sanctuary for citrus (Lemon family) and one for pitcher plant (an insect eating plant) in North east, India.

**2.Ex-situ Conservation (Outside habitats):** Ex-situ conservation is achieved by establishment of gene banks, germ plasm banks, seed banks, zoos, botanical gardens, genetic resource centres, pollen grains, tissue culture and DNA banks. Here endangered plants and animals are collected and bred under controlled conditions in captivity under human care.

The International Board for Plant Genetic Resources was framed in 1974 with its Head quarters in Rome. By 1985, a chain of 43 gene banks was set up in different countries. In India, we have following important gene bank/seed bank facilities.

**(i)** National Bureau of Plant Genetic Resources (NBPGR), New Delhi. Here agricultural and horticultural crops and their wild varieties are preserved by cryo-preservation of seeds, pollens etc. by using liquid nitrogen at a very low temperature of -196°C. Varieties of rice, tomato, onion, chilli, turnip, radish, carrot, tobacco, poppy etc., have been preserved for several years without losing seed viability.

**(ii)** National Bureau of Animal Genetic Resources (NBAGR), Karnal, Haryana. It preserves semen of domesticated bovine animals.

**(iii)** National Facility for Plant Tissue Culture Repository for the conservation of varieties of crop plants or trees by tissue culture. This facility has been created within the NBPGR.

The G-15 countries have also resolved to set up a net work of gene banks to facilitate the conservation of varieties of aromatic and medicinal plants for which India is the networking coordinator country.

**8. EXPLAIN NATIONAL BIODIVERSITY ACT**

**NATIONAL BIODIVERSITY ACT**

To regulate access to genetic resources and associated sharing arrangements, apart from developing policies and programmes on long term conservation and protection of biological resources and associated knowledge, the Biological Diversity Act, 2002 was promulgated. The National Biodiversity Authority (NBA) set up at Chennai on 1st October 2003 as per the provisions of the Biological Diversity Act, 2002 is mandated to facilitate implementation of the Act.

Notable Points:

* All foreign national require approval from NBA for obtaining Biological Resources. (Section – 3)
* Indian individuals/entities to seek approval before transferring knowledge / research and material to foreigners. (Section – 4)
* Prior approval of NBA before applying for any kind of IPR based on research conducted on biological material and or associated knowledge obtained from India. (Section -6)
* Indians required to provide prior intimation to State Biodiversity Boards for obtaining biological material for commercial purposes. SBB can regulate such access. (Section -7)
* Growers and cultivators of Biological Diversity and vaids and hakims who are practicing Indian system of medicines and local people exempted.

**UNIT 4**

**ENVIRONMENTAL POLLUTION AND ITS CONTROL TECHNOLOGIES**

**MULTIPLE CHOICE QUESTIONS:**

1. The Most important indoor air pollutant is (Ans: d)

a) SO2 b) CO2

c) NO2  d) Radon gas

2. Damage to leaf structure by air pollutants causes (Ans: d)

a) Dead areas of leaf b) Chlorophyll reduction

c) Dropping of leaf d) all of these.

3. Air pollutants mixing up with rain can cause (Ans : a)

a) High acidity and low pH b) low acidity and low pH

c) Neutral conditions d) none of these.

4. Damages buildings and causes disfigurement of statues made up of marble and limestone. (Ans: b)

a) SO2 b) sulfuric acid

c) Ozone d) Nitrogen dioxide

5. Pollutants which affect animals and plant health adversely in the presence of sunlight produce (Ans: a)

a) Photochemical smog b) Sulphur dioxide

c) Nitrogen dioxide d) all of these

6. Bhopal gas tragedy occurred due to leakage of (Ans: a)

a) MIC b) DDT

c) SO2 d) Dioxins

7. Oil in water affects fish by affecting (Ans: a)

a) Gills (b) Scales

(c) Eyes (d) none of these

8. Which of the following enhance the frequency of earth quakes? (Ans: d)

(a) Big dams

(b) Underground nuclear testing

(c) Deep well disposal of liquid wastes

(d) All of these

9. The main pollutants emitted by Thermal power plants are (Ans: d)

(a) Nitrogen oxide (b) Sulphur dioxide

(c) Fly ash (d) both b and c

10. CO has affinity for haemoglobin \_\_\_\_\_\_\_\_\_\_\_\_ times more than oxygen (Ans: c)

(a) 120 (b) 140

(c) 210 (d) 220

11. Minimata disease occurred due to consumption of fish contaminated with

(Ans: b)

(a) Mercury (b) Methyl mercury

(c) Arsenic (d) Fluoride

12. Abnormalities due to consumption of endosulphan contaminated (Ans: c)

(a) Rice (b) drinking water

(c) Cashew nuts (d) none of these

13. Following is not a part of UASB process of anaerobic digestion. (Ans: d)

(a) Hydrolysis (b) Acidogenesis

(c) Acetogenesis (d) photolysis

14. --------------------- causes silvering of lower surface of leaf (Ans: d)

(a) NO2 (b) SO2

(c) Ozone (d) PAN

15. Unleaded petrol which was considered to be green fuel for vehicles emits (Ans: c)

(a)Methane (b) Sulphur dioxide

(c) Benzene (d) CFC

16. A house wife using wood as a fuel for cooking inhales \_\_\_\_\_\_\_\_ equivalent to 20packets of cigarette a day. (Ans: d)

(a) Benzene (b) PAN

(c) Formaldehyde (d) Benzo-(a) pyrene

17. Which of the following is not a device to reduce particulate pollution at source? (Ans: b)

(a) Bag house filters (b) Trickling filters

(c) Cyclones (d) Wet scrubbers

18. Which of the following is not a biodegradable wastes (Ans b).

(a) Egg shells (b) Scrap metal

(c) Stale food (d) Tea leaves

19. The amount of atmospheric ozone is measured by (Ans: b)

(a) Absorption spectrometer (b) Dobson spectrometer

(c) Infra red spectrometer (d) mass spectrometer

20. Which of the following gases has maximum contribution to enhanced green house effect? (Ans: c)

(a) CFC’s (b) CH4

(c) CO2 (d) N2O

21. Maximum depletion of ozone occurs on (Ans: c)

(a) Equator (b) North pole

(c) South pole (d) tropics

22. Smog is: (Ans: b)

(a) A natural phenomenon

(b) A combination of smoke and fog

(c) Is colorless

(d) All of the above

23. Which one of the following is a wrong statement? (Ans:d)

|  |  |
| --- | --- |
| A | Greenhouse effect is a natural phenomenon |
| B | Eutrophication is a natural phenomenon in freshwater bodies |
| C | Most of the forests have been lost in tropical areas |
|  | D Ozone in upper part of atmosphere is harmful to anima  24. In an area where DDT had been used extensively, the population of birds declined significant because (Ans:b)   |  |  | | --- | --- | | A | Cobras were feeding exclusively on birds | | B | Many of the birds eggs laid, did not hatch | | C | Birds stopped laying eggs | | D | Earthworms in the area got eradicate |   25. Measuring Biochemical Oxygen Demand (BOD) is a method used for (Ans: c)   |  |  | | --- | --- | | A | Measuring the activity of Saccharomyces cerevisiae in producing curd on a commercial scale | | B | Working out the efficiency of R.B.Cs. about their capacity to carry oxygen | | C | Estimating the amount of organic matter in sewage water | | D | Working out the efficiency of oil driven automobile engines |   26. Identify the correctly matched pair(Ans: c)   |  |  | | --- | --- | | A | Basal Convention – Biodiversity Conservation | | B | Montreal Protocol - Global warming | | C | Kyoto protocol – Climatic change | | D | Ramsar Convention – Ground water pollution | |

27. common indicator organism of water pollution is: (Ans: b)

|  |  |  |
| --- | --- | --- |
| A | Entamoeba histolytica | |
| B | Escherichia coli | |
| C | Eichhornia crassipes | |
| D | Lemna paucicostata | |
|  | |

28. Shell of egg in bird becomes thin (not properly formed) due to the pollution of pesticides. This is due to interference in the activity of : (Ans: a)

|  |  |
| --- | --- |
| A | Calmodulin |
| B | Mg ATPase |
| C | Ca ATPase |
| D | None of these |

|  |
| --- |
|  |

29. Lichens can be used as : (Ans: c)

|  |  |  |
| --- | --- | --- |
| A | Source of wood | |
| B | Initial vegetation for waste lands | |
| C | Bio-indicator for water and air pollution | |
| D | To check the air pollution | |
|  | |

|  |  |
| --- | --- |
| A | Protective resemblance with the surrounding |

|  |
| --- |
|  |

30. The two gases making highest relative contribution to the greenhouse gases are (Ans: b)

|  |  |  |
| --- | --- | --- |
| A | CO2 and N2O | |
| B | CO2 and CH4 | |
| C | CH4 and N2O | |
| D | CFC5 and N2O | |
|  | |

31. The slow rate of decomposition of fallen logs in nature is due to their: (Ans: a)

|  |  |
| --- | --- |
| A | Poor nitrogen content |
| B | Low moisture content |
| C | Low cellulose content |
| D | Anaerobic environment around them |

32. Which one of the following is not a bioindicator of water pollution? (Ans: d)

|  |  |  |
| --- | --- | --- |
| A | Blood-worms | |
| B | Sludge-worms | |
| C | Sewage fungus | |
| D | Stone flies | |
|  | |

33. Which one of the following is the correct percentage of the two (out of the total of 4) green house gases that contribute to the total global warming? (Ans: b)

|  |  |
| --- | --- |
| A | CO2 40%,CFCs 30% |
| B | CFCs 14%, Methane 20% |
| C | Methane 20%, N2O 18% |
|  | D.N2O 6%, CO2 86% |

34. Carbon dioxide is called green-house gas because it is(Ans: a)

|  |  |
| --- | --- |
|  | A.Transparent to sunlight but traps heat |
|  | B.Transparent to heat but traps sunlight |
|  | C.Used in green-house to increase plant growth |
|  | D.Transparent to both sunlight and heat  **.36.Kyoto Protocol in an important international treaty. Following sentences are related to this protocol. Find the wrong one: (Ans: D) a) Kyoto Protocol was adopted in 1997. b) The first commitment period of Kyoto Protocol ended in 2012 c) Kyoto Protocol is about reduction of emission of greenhouse gases. d) The second commitment period of Kyoto Protocol will end in 2030.**  **37. The carbon-dioxide content in the Earth’s atmosphere is currently around 400 ppm. It is estimated that before 1500 AD, CO2 content in earth’s atmosphere was between 200 and 300 ppm. Which of the following greatly contributed this change?** (Ans: B) **a) Invention of agriculture b) Industrial Revolution c) American Revolution d) World War I and II**.  **38. Which of the following appears to contribute to global cooling rather than global warming?** (Ans: B) **a) nitrous oxide** **b) aerosols** **b) methane** **c) chlorofluorocarbons**  **39. Biodiversity is highest in which type of the following forests?** (Ans: D) **a) Alpine meadows b) Deciduous monsoon forests c) Coniferous forests d) Wet evergreen equatorial forests** [ESE 2014]  .  **40. Environmental Impact Assessment (EIA) is mandatory under which one of the following India legislations:** (Ans: D) **a) Indian Forest Act** **b) Air (Prevention and Control of Pollution) Act** **c) Wildlife Protection Act** **d) Environment (Protection) Act**  .  **41. Mercury is considered hazardous to human health. It damages brain, kidneys and lungs and also results in various diseases. Mercury pollution is a serious issue because:** (Ans: B) **a) Mercury is a pure metal and hard to digest.** **b) Mercury accumulates and concentration increases high up the food chain.** **b) Mercury is light and easily dispersed by wind.** **d) Mercury is very soluble in water and easily absorbed by human body.**  **41. What is Eutrophication?** (Ans:Ba) **a) thermal change in water b) filling up of water body with aquatic plants due to excessive nutrients c) pollution of water due to solid waste d) none of the above** |

1. **SHORT ANSWER TYPE QUESTIONS**
2. **Define pollutant?**

Ans: Any undesirable foreign matter added to the environment that alters the natural quality of the environment and causes damage to humans, plants and animals is known as Pollutant.

Ex: Mercury, arsenic hydrocarbons.

**2. What are the Primary pollutants?**

Ans: The pollutants which are released directly into the atmosphere is termed as Primary pollutants. Ex: Carbon monoxide, oxides of nitrogen and sulphur.

**3. What are the Secondary pollutants?**

Ans: The Pollutants which are released through chemical reactions are termed as secondary pollutants.

Ex: Acid rains, Ozone layer depletion, Photochemical smog

**4.** **What is Photochemical smog?**

Ans: Photochemical smog is the combination of smoke and Fog.

**5. Define Air pollution?**

Ans: Air pollution can be defined as the excessive discharge of undesirable foreign matters /substances into the atmosphere, thereby adversely affecting the quality of air and causing damage to humans, plants and animal lives.

**6. What is Minamata disease?**

Ans: When mercury is dumped into water, it is transformed into water soluble methyl mercury by bacterial action. This disease called Minamata disease occurred due to consumption of methyl mercury contaminated fish caught from Minamata Bay in Japan.

Symptoms: Numbness of Body parts, Vision, hearing problems and abnormal mental behavior

**7. What is Blue-baby syndrome?**

Ans: It is caused by Excess amount of nitrate in drinking water. The disease develops when a part of hemoglobin is converted into non-functional oxidized form. This condition is also called as methemoglobinemia.

**8. What is Itai - Itai disease?**

Ans: The disease was caused by cadmium contaminated rice. Rice fields were irrigated with effluents of Zinc Smelters and drainage water from mines. In this disease bones, liver, kidney, lungs, pancreas and thyroid are affected.

**7. Difference between Point and Non-point sources of pollution?**

Ans: Point sources means we can easily identify the particular point of pollution whereas in case of Non-point source we cannot find the particular point of pollution ( the point where pollutants enters).

**8. Write about Secondary treatment in waste water treatment?**

Ans: Secondary treatment is also called as Biological process because there will be the presence of algae and other micro-organisms. It includes two processes 1. Activated sludge system and 2. Trickling filters.

**9. What is Chlorination?**

Ans: Adding chlorine to water is termed as Chlorination.

**10. E-waste ?**

Ans: E-waste stands for Electronic waste. The waste coming from electronic products which are not working and expired is said to be E-Waste. It consists of Hazardous wastes which are harmful to human health and to the environment. Ex: Mercury, Arsenic, Polychlorinated Biphenyls.

**11. Green house effect or Global warming?**

Ans: Heating of earth’s surface is termed as Global warming?

**12. What are Green house gases?**

Ans: The gases which are responsible for global warming are called as Green house gases. Ex: Hydrocarbons, SF6, etc.

**13. Montreal protocol?**

Ans: It talks about reducing Ozone Depleting Substances. It was adopted on Sep 16; 1987.Every year 16 Sep is celebrating as World Ozone Day.

**14. Kyoto protocol?**

Ans: It talks about reducing Green house gases. It was adopted on Dec 11, 1997.

**15. Earth summit?**

Ans:It is also called as United Nations Conference on Environment and Development(UNCED) which took place on June3-14, 1992 in Rio-de janerio,Brazil.

**16. Expand GWP?**

Ans: Global Warming Potential. The ability to cause global warming is called as GWP.

1. **ESSAY QUESTIONS**
2. **Give an account of adverse effects of Air pollution.**

**Ans:** Air pollution has adverse effects on living organisms and materials.

1. **Effects on human health:**

* Health Effects of Sulphur Dioxide (SO2):

Human beings chronically exposed to SO2 have higher incidence of cough, shortness of breath, bronchitis, colds of long duration and fatigue. Most of the SO2 in the atmosphere is converted to sulphate salts, which are removed by sedimentation or by washout along with precipitation thereby making rain water acidic due to sulphuric acid formation.

* Health Effects of Nitrogen Dioxide (NO2):

The oxides of nitrogen are toxic gases which enter the human body during breathing. High concentration of NO2 may increase susceptibility to respiratory pathogens and also increases risk of acute respiratory diseases like bronchitis, chronic fibrosis, emphysema and bronchopneumonia. N02 exposure can cause decrement in lung functions.

#### Health Effects of Particulate Matter:

#### Human respiratory system has a number of mechanisms for protection from air pollution. Bigger particles (>10µm) can be trapped by the hairs and sticky mucus in the lining of the nose. Smaller particles can reach trachea bronchial system and there they get trapped in mucus. These are sent back to throat by beating of hair like cilia from where these can be removed by spitting or swallowing.

#### Health Effects of Carbon Monoxide (CO):

Carbon monoxide is absorbed from the lung tissue in blood stream. Competitive bending between carbon monoxide and oxygen to haemoglobin (Hb) in red blood cells (RBC) then occur forming carboxy haemoglobin (COHb) and oxyhaemoglobin (O2Hb) respectively. Toxic effects of CO are mainly due to its high affinity for Hb which is 240 times greater than oxygen affinity. The COHb in blood of exposed population may be between 3.0 and 5.3 per cent whereas the safe limit is less than 2 per cent.

#### Health Effects of Ozone:

#### High elevation of ozone causes major problem of human health which includes eye, nose and throat irritation, chest discomfort, cough and headache, Ozone is a respiratory irritant, reacts rapidly with tissues and airways lining of lungs.

#### Health Effects of Benzene:

#### Exposure to excessively high level of benzene may cause cancer in kidney, testis, brain, pancreas, stomach, lung, respiratory tract, bladder and uterus.

1. **Effects on plants:**

Air pollution leads to losses in crops, trees, vegetation and ornamental plants. Human commercial and industrial activities lead to air pollution, which has drastic effects on both plants and animals. The effects of air pollution on plants may be evident in a number of ways. Foliage develops injuries that, with time, appear as necrotic lesions. Yellowing of leaves (chlorosis) may also be an effect of acidification. Other symptoms include mottling, bronzing, reddening and stunted growth. When sulfur dioxide and nitrogen oxides combine with water in the atmosphere, they form acid rain, which intoxicates the soil and waters where it falls, causing damage to plants. Acid rain weakens trees by destroying their leaves, decreasing the nutrients available to them. The toxic substances released from the soil also poison the plants. Acid water dissolves nutrients and other important minerals in the soil and washes them away before they can be consumed by plants. Additionally, Ozone holes in the upper atmosphere allow excessive infiltration of ultraviolet radiation from the sun to the Earth causing harm to plants. Similarly, Ozone in the lower atmosphere prevents plant respiration by clogging stomata and hinders plant’s photosynthesis rates, hence stunting the plant's ability to grow.

1. **Effects on aquatic life:**

Air pollutants mixing up with rain can cause high acidity (lower pH) in fresh water lakes. This affects aquatic life especially fish. Some of the fresh water lakes have experienced total fish death.

1. **Effects on materials:** Sulfuric acid formed by the atmospheric SO₂ and water vapors accelerates corrosion of metallic surfaces. Metal parts of buildings, vehicles, bridges, wires and railway tracks are affected. Sulfuric acid also damages buildings and disfigurement of statues made of marble and limestone. Damages leather binding of books. Ozone in atmosphere causes cracking of rubber. Nylon stockings are weakened and ultimately damaged. Tyres of various vehicles are also damaged by Ozone. Oxides of Nitrogen and Ozone can also cause fading of Cotton and rayon fibers.
2. **Enumerate various methods for control of Air pollution.**

Ans: The impact of air pollution on human health includes impairment of health, respiratory problems, allergies, etc. Further, air pollution greatly impacts ecological diversity and environmental sustainability.

We all should become aware of the growing air-pollution and the need to take steps to make it free from pollution. Some of the measures to reduce and control air pollution are as follows:

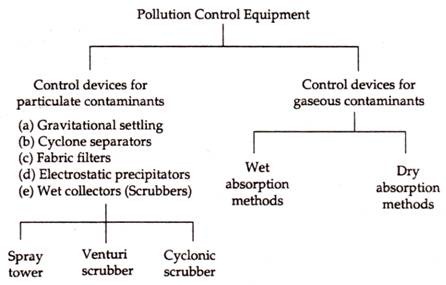
1. The forest cover should be protected. Adequate forest cover is essential for maintaining the quality of air. Trees absorb carbon-dioxide (CO2) and releases oxygen (O2).
2. Green belts should be created. Such areas should be developed around densely populated cities. There should be strict restriction for establishment of large buildings and industries along the Green belt areas.
3. Automobile engines should be redesigned in such a way that their emissions cause minimum pollution. Old automobile engines should be replaced by new ones. People should be encouraged to share the vehicle, and to avoid vehicles for short distances.
4. Use of railway steam engine should be stopped. The burning of combustible materials such as coal produces poisonous gases that are released into the air. Electric engines should be used instead of steam or diesel engines.
5. Industrial areas should be located at a safe distance from the residential areas.
6. Newly designed smoke free furnaces should be used.
7. Forest fires should be checked. Adequate preventive measures should be adopted to protect the forests.
8. In industries there should be the arrangement for pollution control.
9. Cheap devices for controlling air pollution should be developed.
10. Air pollution can be checked only through the joint efforts of the government, non‑government organizations and the general public.

**Reduction of Air pollution at source:**

**Pollution control equipment’s are generally classified into two types:**

(a) Control devices for particulate contaminants.

(b) Control devices for gaseous contaminants.

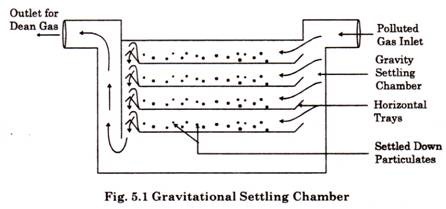
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**Control Devices for gaseous Contaminants**: Gaseous pollutants can be reduced by physical adsorption on porous solid materials like activated charcoal, silica gel, Fuller’s earth etc. Effluent gases can be absorbed in liquid absorbent, e.g. SO2 absorbed in ammonia solution. They can be removed by condensation which is carried out by cooling medium in tubes where the gases in contact condense and can be collected thereafter. Combustion can be used to reduce pollution by burning the pollutants in combustion equipment at optimal conditions of oxygen and temperature.

**Control Devices for Particulate Contaminants:**

#### (1) Gravitational Settling Chamber:

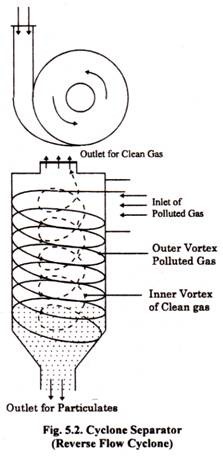
For removal of particles exceeding 50 µm in size from polluted gas streams, gravitational settling chambers (Fig 5.1) are put to use.

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This device consists of huge rectangular chambers. The gas stream polluted with particulates is allowed to enter from one end. The horizontal velocity of the gas stream is kept low (less than 0.3 m/s) in order to give sufficient time for the particles to settle by gravity.

The particulates having higher density obey Stoke’s law and settle at the bot­tom of the chamber from where they are removed ultimately. The several hori­zontal shelves or trays improve the collection efficiency by shortening the settling path of the particles.

**Cyclone Separators (Reverse flow Cyclone):** Instead of gravitational force, centrifugal force is utilized by cyclone separators, to separate the particulate matter from the polluted gas. Centrifugal force, several times greater than gravitational force, can be generated by a spinning gas stream and this qual­ity makes cyclone separators more effec­tive in removing much smaller parti­culates than can possibly be removed by gravitational settling chambers.A simple cyclone separator (Fig 5.2) con­sists of a cylinder with a conical base. A tangential inlet discharging near the top and an outlet for discharging the particulates is present at the base of the cone.

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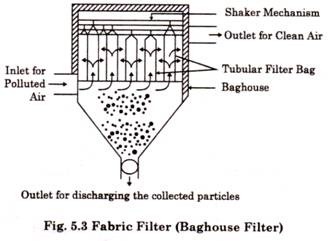
**Mechanism of Action:**

The dust laden gas enters tangentially, receives a rotating motion and generates a centrifugal force due to which the particulates are thrown to the cyclone walls as the gas spirals upwards inside the cone (i.e. flow reverses to form an inner vortex which leaves flow through the outlet). The particulates slide down the .walls of the cone and are discharged from the outlet.

**(3) Fabric Filters (Bag house Filters):**

In a fabric filter system, a stream of the polluted gas is made to pass through a fabric that filters out the particulate pollutant and allows the clear gas to pass through. The particulate matter is left in the form of a thin dust mat on the insides of the bag. This dust mat acts as a filtering medium for further removal of particulates increasing the efficiency of the filter bag to sieve more sub mi­cron particles (0.5 µm).

A typical filter (Fig 5.3) is a tubular bag which is closed at the upper end and has a hopper attached at the lower end to collect the particles when they are dislodged from the fabric. Many such bags are hung in a bag house. For efficient filtration and a longer life the filter bags must be cleaned occasionally by a mechanical shaker to prevent too many particulate layers from building up on the inside surfaces of the bag.

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**(4) Electrostatic Precipitators:**

The electrostatic precipitator (Fig. 5.4) works on the principle of electrostatic precipitation i.e. electrically charged particulates present in the polluted gas are separated from the gas stream under the influence of the electrical field.

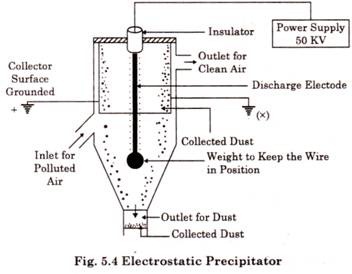
**A typical wire and pipe precipitator consists of:**

(a) A positively charged collecting surface (grounded).

(b) A high voltage (50 KV) discharge electrode wire.

(c) Insulator to suspend the electrode wire from the top.

(d) A weight at the bottom of the electrode wire to keep the wire in position.

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**Mechanism of Action:**

The polluted gas enters from the bottom, flows upwards (i.e. between the high voltage wire and grounded collecting surface). The high voltage in the wire ionises the gas. The negative ions migrate towards the grounded surface and pass on their negative charge to the dust particles also. Then these negatively charged dust particles are electrostatically drawn towards the positively charged collector surface, where they finally get deposited.

The collecting surface is rapped or vibrated to periodically remove the collected dust-particles so that the thickness of the dust layer deposited does not exceed 6 mm, otherwise the electrical attraction becomes weak and efficiency of the electrostatic precipitator gets reduced.

As the electrostatic precipitation has 99 + percent efficiency and can be oper­ated at high temperatures (600°C) and pressure at less power requirement, therefore, it is economical and simple to operate compared to other devices.

**(5) Wet Collectors (Scrubbers):**

In wet collectors or scrubbers, the particulate contaminants are removed from the polluted gas stream by incorporating the particulates into liquid droplets.

**Common wet scrubbers are:**

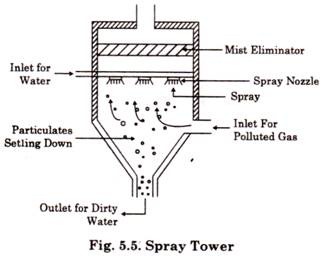
(i) Spray Tower

(ii) Venturi Scrubber

(iii) Cyclone Scrubber

**(i) Spray Tower:**

Water is introduced into a spray tower (Fig. 5.5.) by means of a spray nozzle (i.e. there is downward flow of water). As the polluted gas flows upwards, the particulates (size exceeding 10 µm) present collide with the water droplets be­ing sprayed downward from the spray nozzles. Under the influence of gravita­tional force, the liquid droplets containing the particulates settle to the bottom of the spray tower.

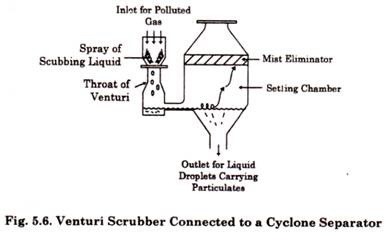
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**(ii) Venturi Scrubber:**

Submicron particulates (size 0.5 to 5 µn) associated with smoke and fumes are very effectively removed by the highly efficient Venturi Scrubbers. As shown in Fig 5.6 a Venturi Scrubber has a Venturi shaped throat section. The polluted gas passes downwards through the throat at the velocity of 60 to 180 m/sec.

A coarse water stream is injected upwards into the throat where it gets atomised (i.e. breaks the water into droplets) due to the impact of high velocity of the gas. The liquid droplets collide with the particulates in the pol­luted gas stream.

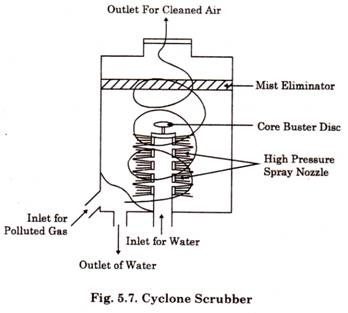
The particles get entrained in the droplets and fall down to be removed later on. Venturi Scrubbers can also remove soluble gaseous contami­nants. Due to the atomisation of water there is proper contact between the liquid and the gas increasing the efficiency of the Venturi Scrubber (their power cost is high because of the high inlet gas velocity).

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To separate the droplets carrying the particulate matter from the gas stream, this gas-liquid mixture in the Venturi Scrubber is then directed into a separa­tion device such as a cyclone separator.

**(iii) Cyclone Scrubber:**

The dry cyclone chamber can be converted into a wet cyclone scrubber by in­serting high pressure spray nozzles at various places within the dry chamber (Fig. 5.7).

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The high pressure spray nozzles generate a fine spray that intercepts the small particles in the polluted gas. The centrifugal force throws these particles to­wards the wall from where they are drained downwards to the bottom of the scrubber.

1. **Briefly describe the sources, effects and control of noise pollution.**

**Ans: Noise pollution** (also sound pollution, sound disturbance) refers to the excessive and troublesome sound that is injurious to health.

Noise pollution refers to the presence of such levels of noise or sound in the environment that are disturbing, irritating and annoying to living beings.

So, noise pollution is noise that causes discomfort and harm to living being’s mental and physical health. Such noise is considered harmful either physically or psychologically. It is one of the major causes for deafness and other health hazards. Even animals suffer from excessive environmental noise.

## Causes of Noise pollution

Noise pollution can be caused by several phenomenon including industrial activity, and social activity (such as explosion of fire crackers, loud parties), and surface travel. The many causes of noise pollution are discussed below:

**1. Fire crackers:** Fire crackers are exploded to make huge sound during celebrations and festive occasions.  It is common sight to witness the firing of crackers at live concerts.

**2. Transportation vehicles:** Noise pollution is severest in the cities. The different modes of transportation (land, air and water), such as motor-cars, buses, trains, trams, airplanes, etc. produces sound that disturbs the human mind.

**3. Microphones:** The unrestricted use of microphones during social and political events.

**4. Loud speakers:** During social events and other festive occasions, people use loud speakers in unjustified manner.

**5. Factories and industries:** In large cities, there are large number of factories, mills and industries. These industrial sites produce immense environmental noise to disturb the habitats of nearby residential areas.

**6. Domestic appliances:** Even at homes, people use large number of domestic appliances such as grinder, mixer, juicer, etc.

**7. Loud music:** Playing music in high volume,

**8. Television:** Television also causes sound and watching television for long hours in just as harmful for ears as they are for eyes.

**9. Building and construction sites near residential areas:** The building and construction activity involves use of sound producing equipment such as cement-mixer, road-roller, crane, etc.

All the above activities produce enough noise to disturb the health and mind of human-beings and other living bodies.

## Effects of Noise Pollution

Noise pollution affects the human mind and body negatively. The ill-effects of noise pollution are many. It is the major cause for several ailments. The quality of human life gets disrupted. The lives of the children, the aged or the ailing people become miserable.

**1. Loss of hearing and deafness:** Noise above the tolerable threshold is the leading cause for loss of hearing and deafness.

**2. Cardiac disturbance:** Noise increases the risk of cardiac disturbance including coronary artery disease or ischemic heart disease (IHD).

**3. Sleeplessness:**Noise may make people restless and tired. It may cause disrupted sleeping pattern or may keep people away from sound sleep. In the long-term, due to tiredness and lack of sleep, the immune system may get compromised.

**4. Headache:** Human mind can tolerate sound only to a limited extent. Excess noise causes headache.

**5. Stress, tension and aggressiveness:**Loud noises can be very stressful. Constant exposure to irritating sound may cause stress and tension. The behavior of people often becomes aggressive. Other than psychological imbalance, is causes physical illness such as increased blood pressure, cardiac disturbance and insomnia.

**6. Irregular blood pressure:** For good health, it is very important to maintain normal pressure in the arteries both during the heartbeat and between the heartbeat. Noise may contribute to fluctuations in the levels of blood pressure.

**7. Mental imbalance and nervous debility:**Mental illness is among the worst negative effects of noise pollution. People may find it difficult to cope with their normal routine life. Human mind cannot accept sound beyond a certain level. Excess sound may lead to mental imbalance and nervous disability.

**8. Psychological imbalance:** It may also cause psychological imbalance.

**9. Difficulty in talking:** Due to excessive noise, it becomes very difficult to talk on roads or inside malls.

## Prevention of Noise Pollution

Some effective measures should be taken too solve the problem. The following measures can be taken to prevent noise pollution:

* To prevent and control noise pollution it is necessary to create public awareness. Only law is not sufficient. People must be made aware of the harmful consequences of noise pollution.
* People should be made aware that excessive noise beyond certain limits may cause deafness.
* They should know that injuries caused by sound pollution are often irreversible.
* There should be minimum use of sound producing instruments. There should be proper regulations for the use of loudspeakers and other devices that produce noise beyond that are beyond the toleration limits of human-beings.
* The Pollution Control Board and the High Court have already taken effective measures to bring sound pollution under control. Adequate measures should be taken to ensure that noise related restrictions are not violated.
* Anti-pollution laws should be enacted and enforced.
* Ban of fire crackers should be imposed and electric horns should be replaced by bulb horns.
* The use of microphones should be controlled and regulated.

1. **Enumerate with examples the major sources of surface water pollution and ground water pollution.**

**Ans: Ground water pollution:** Forms about 6.2% of the total water available on planet earth and is about 30 times more than surface water (streams, lakes and estuaries). Ground water is seemed to be less prone to pollution as the soil mantle through which water passes helps to retain various contaminants due to its cation exchange capacity. Various potential sources of ground water pollution are:

* Storage Tanks

May contain gasoline, oil, chemicals, or other types of liquids and they can either be above or below ground. There are estimated to be over 10 million storage tanks buried in the United States and over time the tanks can corrode, crack and develop leaks. If the contaminants leak out and get into the groundwater, serious contamination can occur.

* Septic Systems

Onsite wastewater disposal systems used by homes, offices or other buildings that are not connected to a city sewer system. Septic systems are designed to slowly drain away human waste underground at a slow, harmless rate. An improperly designed, located, constructed, or maintained septic system can leak bacteria, viruses, household chemicals, and other contaminants into the groundwater causing serious problems.

* Uncontrolled Hazardous Waste

In the U.S. today, there are thought to be over 20,000 known abandoned and uncontrolled hazardous waste sites and the numbers grow every year. Hazardous waste sites can lead to groundwater contamination if there are barrels or other containers laying around that are full of hazardous materials. If there is a leak, these contaminants can eventually make their way down through the soil and into the groundwater.

* Landfills

Landfills are the places that our garbage is taken to be buried. Landfills are supposed to have a protective bottom layer to prevent contaminants from getting into the water. However, if there is no layer or it is cracked, contaminants from the landfill (car battery acid, paint, household cleaners, etc.) can make their way down into the groundwater.

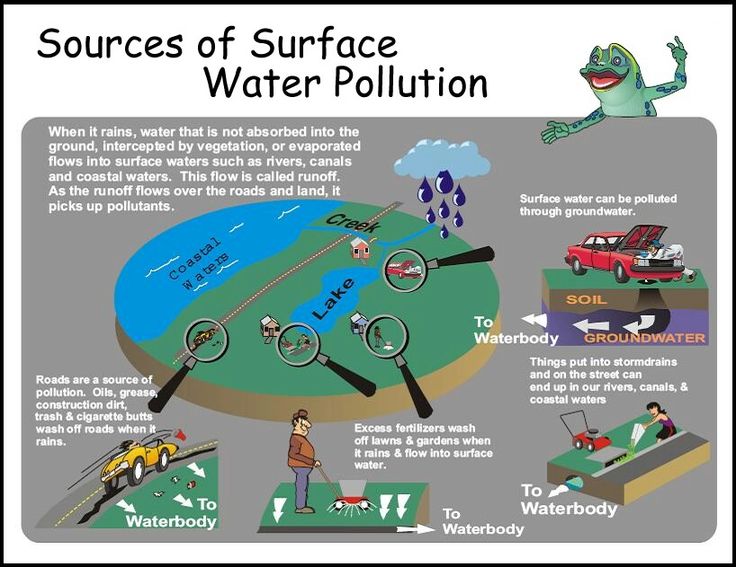
* Chemicals and Road Salts

The widespread use of chemicals and road salts is another source of potential groundwater contamination. Chemicals include products used on lawns and farm fields to kill weeds and insects and to fertilize plants, and other products used in homes and businesses. When it rains, these chemicals can seep into the ground and eventually into the water. Road salts are used in the wintertime to put melt ice on roads to keep cars from sliding around. When the ice melts, the salt gets washed off the roads and eventually ends up in the water.

* Atmospheric Contaminants

Since groundwater is part of the hydrologic cycle, contaminants in other parts of the cycle, such as the atmosphere or bodies of surface water, can eventually be transferred into our groundwater supplies.

**Surface water pollution:** The major sources of surface water pollution are:



**Sewage and waste water:** The sewage and waste water that is produced by each household is chemically treated and released in to sea with fresh water. The sewage water carries harmful bacteria and chemicals that can cause serious health problems. Pathogens are known as a common water pollutant; The sewers of cities house several pathogens and thereby diseases. Microorganisms in water are known to be causes of some very deadly diseases and become the breeding grounds for other creatures that act like carriers. These carriers inflict these diseases via various forms of contact onto an individual. A very common example of this process would be Malaria.

**Industrial waste:** Industries produce huge amount of waste which contains toxic chemicals and pollutants which can cause [air pollution](http://www.conserve-energy-future.com/causes-effects-solutions-of-air-pollution.php) and damage to us and our environment. They contain pollutants such as lead, mercury, sulphur, asbestos, nitrates and many other harmful chemicals. Many industries do not have proper waste management system and drain the waste in the fresh water which goes into rivers, canals and later in to sea. The toxic chemicals  have the capability to change the color of water, increase the amount of minerals, also known as Eutrophication, change the temperature of water and pose serious hazard to water organisms.

**Marine dumping:** The garbage produce by each household in the form of paper, aluminum, rubber, glass, plastic, food if collected and deposited into the sea in some countries. These items take from 2 weeks to 200 years to decompose. When such items enter the sea, they not only cause water pollution but also harm animals in the sea.

**Accidental Oil leakage:** Oil spill pose a huge concern as large amount of oil enters into the sea and does not dissolve with water; there by opens problem for local marine wildlife such as fish, birds and sea otters. For e.g.: a ship carrying large quantity of oil may spill oil if met with an accident and can cause varying damage to species in the ocean depending on the quantity of oil spill, size of ocean, toxicity of pollutant.

**Chemical fertilizers and pesticides:** Chemical fertilizers and pesticides are used by farmers to protect crops from insects and bacteria’s. They are useful for the plants growth. However, when these chemicals are mix with water produce harmful for plants and animals. And also, when it rains, the chemicals mix with rainwater and flow down into rivers and canals which pose serious damages for aquatic animals.

**Waste heat:** Waste heat from industrial discharges increases the temperature of water bodies and affects distribution and survival of sensitive species.

**Synthetic detergents:** used in washing and cleaning produce foam and pollute water.

1. **Classify solid waste .what are the sources of urban and industrial solid wastes?**

**Ans: Solid Waste Management:**

Solid Waste is defined as “ any garbage, refused materials, sludge from a waste treatment plant and other discarded material including solids, semisolids etc resulting from industrial, commercial, mining, agricultural operations etc.”

Solid Waste Management has become very important role in order to minimize the adverse effects of solid wastes. Solid waste ( other than liquid or gaseous ) can be classified as Municipal Solid Waste ( MSW ); Industrial Solid Waste; Hazardous Solid Waste; Agriculture Solid Waste; Mining Waste, Sewage Sludge Waste etc..

Solid wastes are being produced since the beginning of civilization. The disposal of Solid Waste has been increased due to the rapid developments in industrialization and urbanization. High population density, intensive land use for residential, commercial and industrial activities led to generation of more solid waste. In Andhra Pradesh, the solid waste generated in medium and small municipalities in the range of 30 – 150 MT / day. The per capita generation of Municipal solid waste in class I cities is in between 100 – 500 gms / day per person.

**Sources of Solid Wastes:**

1. **Municipal Solid Waste** is commonly known as garbage consists of packing materials,furniture, clothing, bottles, food scraps, newspapers, home appliances; paints, batteries etc. Municipal solid wastes are arise from residential quarters, commercial (markets, hotels, garages); institutions; public places, open areas/streets, parks, play grounds etc. MSW also include the following wastes:

**Food Wastes** usually generate from domestic houses, hotels, markets and consist of fruits,vegetable residues resulting from the handling, preparation, cooking and eating of foods. **Rubbish waste** consists of combustible wastes (papers; cardboards, torn clothes, plastics, woodetc) and non – combustible waste (glass, crockery, aluminum tins, ferrous metals; construction wastes).

**Demolition & Construction wastes** result from the construction, remodeling and repairing ofresidential, commercial buildings and industrial factories. These wastes include dust, stones, concrete, bricks, steel pieces etc.

**Special Wastes** include street sweepings, road side litter, drainage debris; dead animals andabandoned vehicle parts.

1. **Industrial Waste** arise from industrial activities such as chemical industries; metal andmineral processing industries. Radio Active wastes are generated by Nuclear Power Plants. Thermal Power Plants produce fly ash in large quantities. Fly ash is a fine solid particles result from the burning of wood, coal and other combustible wastes.
2. **Hazardous Solid Waste** is any solid waste or combination of wastes that posses a substantialdanger, now or in future to human beings and plant / animal life and cannot be handled or disposed. The following is a list of types of hazardous wastes:

→ wastes from specific and non-specific sources. Ex: Disposable synergies from hospitals is a

Specific source identified as hazardous solid waste.

→ Ignitable materials (easily inflammable below 60oC)

→ Corrosive materials (iron rods / pieces)

→Reactive materials (undergoes rapid reaction with water or other substances and releases toxic gases. Ex: limestone / marble).

→ Toxic materials which consists of Pb, Cl (Toxic to human beings)

**Effects of Solid Waste:** The improper handling and transfer of the solid wastes results in varioushealth and environmental problems. The main impacts of waste accumulation are:

* Garbage dumping places are breeding places for diseases.
* Rats and pigs roam and feed on garbage and transmit diseases like brain fever from pigs to human beings and plague from Rats.
* Solid wastes may choke the drains and gully pits resulting in water logging which in turn results in breeding of mosquitoes and then cause for Malaria & dengue in human beings.
* Noxious fumes (harmful gas) may pollute air due to the burning of waste products especially plastic containers.
* Obnoxious (very unpleasant) odours pollute the air due to decomposition of organic solid wastes.
* Municipal solid wastes heap up on roads due to improper disposal system. Every year several tones of solid waste is dumped along the high-ways thereby spoiling the landscape (appearance of an area of land).
* Urban and industrial solid wastes often contain a variety of toxic chemicals which may enter into the food chain and affect both terrestrial and aquatic organisms.

1. **What is waste water treatment and what is the step wise process of waste water treatment?**

**Ans:** Wastewater treatment is the process of converting wastewater – water that is no longer needed or is no longer suitable for use – into bilge water that can be discharged back into the [environment](http://www.conserve-energy-future.com/top-25-environmental-concerns.php). It’s formed by a number of activities including bathing, washing, using the toilet, and rainwater runoff. Wastewater is full of contaminants including bacteria, chemicals and other toxins. Its treatment aims at reducing the contaminants to acceptable levels to make the water safe for discharge back into the environment.

There are two wastewater treatment plants namely chemical or physical treatment plant, and biological wastewater treatment plant. Biological waste treatment plants use biological matter and bacteria to break down waste matter. Physical waste treatment plants use chemical reactions as well as physical processes to treat wastewater. Biological treatment systems are ideal for treating wastewater from households and business premises. Physical wastewater treatment plants are mostly used to treat wastewater from industries, factories and manufacturing firms. This is because most of the wastewater from these industries contains chemicals and [other toxins](http://www.conserve-energy-future.com/top-10-worst-toxic-pollution-problems.php) that can largely [harm the environment](http://www.conserve-energy-future.com/causes-and-effects-of-environmental-degradation.php).

Treatment of water aims at reduction of BOD, COD, Eutrophication, etc. of receiving water bodies and prevention of disease due to pathogenic organisms present in waste water.

## Step by Step Wastewater Treatment Process:

**1. Wastewater Collection**

This is the first step in waste water treatment process. Collection systems are put in place by municipal administration, home owners as well as business owners to ensure that all the wastewater is collected and directed to a central point. This water is then directed to a treatment plant using underground drainage systems or by exhauster tracks owned and operated by business people. The transportation of wastewater should however be done under hygienic conditions. The pipes or tracks should be leak proof and the people offering the exhausting services should wear protective clothing.

**2. Odor Control**

At the treatment plant, odor control is very important. Wastewater contains a lot of dirty substances that cause a foul smell over time. To ensure that the surrounding areas are free of the foul smell, odor treatment processes are initiated at the treatment plant. All odor sources are contained and treated using chemicals to neutralize the foul smell producing elements. It is the first wastewater treatment plant process and it’s very important.

**3. Screening**

This is the next step in wastewater treatment process. Screening involves the removal of large objects for example nappies, cotton buds, plastics, diapers, rags, sanitary items, nappies, face wipes, broken bottles or bottle tops that in one way or another may damage the equipment. Failure to observe this step, results in constant machine and equipment problems. Specially designed equipment is used to get rid of grit that is usually washed down into the sewer lines by rainwater. The solid wastes removed from the wastewater are then transported and [disposed off in landfills](http://www.conserve-energy-future.com/15-easy-ways-to-reduce-landfill-waste.php).

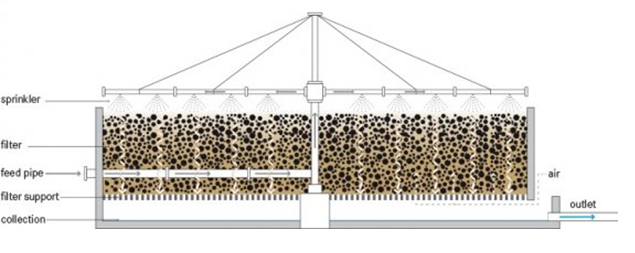
1. **Primary Treatment**

This process involves the separation of macrobiotic solid matter from the wastewater. Primary treatment is done by pouring the wastewater into big sedimentation tanks or clarifier where most of the suspended solids settle down due to gravity. For better removal of suspended solids, sometimes chemically treated polymers are used. The remaining water is then pumped for secondary treatment. About 35% BOD and 60% of suspended solids are removed during primary treatment.

1. **Secondary Treatment:**

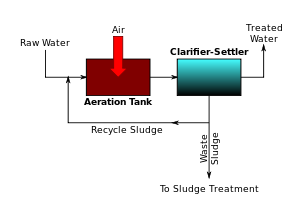
It is a biological process which involves microorganisms. It removes up to 90% of the BOD and 90% of suspended solids. Biodegradable oxygen demanding wastes are stabilized. Following are the various approaches adopted in secondary treatment.

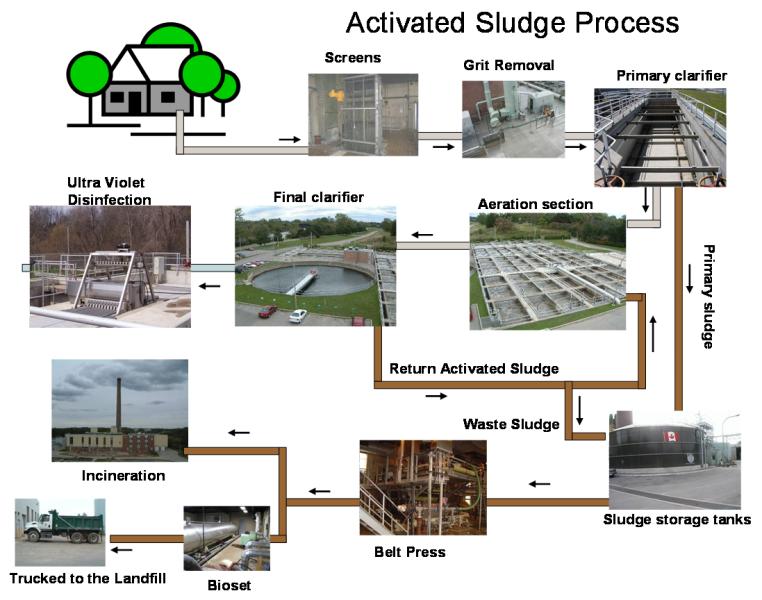
* Trickling Filters: [Trickling filters](http://www.sswm.info/glossary/2/lettert#term3380) are a [secondary treatment](http://www.sswm.info/glossary/2/letters#term964) after a primary setting process. It consists of a cylindrical tank and is filled with crushed stones or pebbles covered with slime which consists mainly of anaerobic bacteria, algae, fungi, protozoa, worms and insect larvae. Sewage is degraded by the aerobic bacteria when it passes through the bed and is collected at the bottom of the filter. Some of the treated sewage may be circulated along the influent. It helps in better removal of organic matter and also keeps the filter moist when the flow rate over the filter is slow.



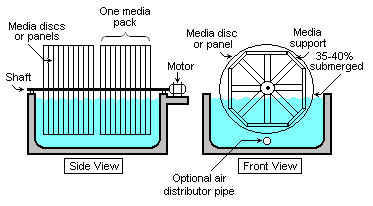
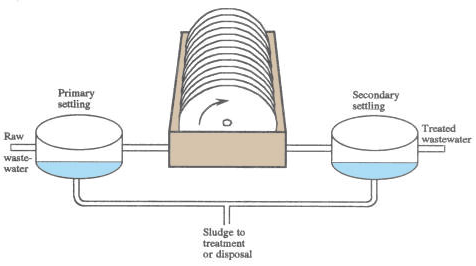
* Activated sludge process: An [activated sludge](http://www.sswm.info/glossary/2/lettera#term18) process refers to a multi-chamber  [reactor](http://www.sswm.info/glossary/2/letterr#term425) unit that makes use of highly concentrated [microorganisms](http://www.sswm.info/glossary/2/letterm#term368) to degrade [organics](http://www.sswm.info/glossary/2/lettero#term1072) and remove [nutrients](http://www.sswm.info/glossary/2/lettern#term380) from [wastewater](http://www.sswm.info/glossary/2/letterw#term1035) to produce a high-quality [effluent](http://www.sswm.info/glossary/2/lettere#term143). To maintain  [aerobic](http://www.sswm.info/glossary/2/lettera" \l "term20" \t "_blank) conditions and to keep the [activated sludge](http://www.sswm.info/glossary/2/lettera#term18) suspended, a continuous and well-timed supply of oxygen is required.  
  [Activated sludge](http://www.sswm.info/glossary/2/lettera#term18) consists of [flocs](http://www.sswm.info/glossary/2/letterf" \l "term2399" \t "_blank) of [bacteria](http://www.sswm.info/glossary/2/letterb#term38), which are suspended and mixed with [wastewater](http://www.sswm.info/glossary/2/letterw#term1035) in an aerated tank. The [bacteria](http://www.sswm.info/glossary/2/letterb#term38) use the [organic](http://www.sswm.info/glossary/2/lettero#term385) pollutants to grow and transform it to [energy](http://www.sswm.info/glossary/2/lettere#term1370), water, CO2 and new cell material. A *physical*[pre-treatment](http://www.sswm.info/glossary/2/letterp#term3365) *unit*, a post-[settling](http://www.sswm.info/glossary/2/letters#term965) unit (a clarifier) from which active [sludge](http://www.sswm.info/glossary/2/letters#term976) is re-circulated to the aerated tank, and excess [sludge treatment](http://www.sswm.info/glossary/2/letters#term1358), are compulsory for appropriate treatment.

[Activated sludge](http://www.sswm.info/glossary/2/lettera#term18) systems can treat [blackwater](http://www.sswm.info/glossary/2/letterb" \l "term49" \t "_blank)*,*[brownwater](http://www.sswm.info/glossary/2/letterb" \l "term50" \t "_blank)*,*[greywater](http://www.sswm.info/glossary/2/letterg" \l "term109" \t "_blank)*,*[faecal sludge](http://www.sswm.info/glossary/2/letterf" \l "term3336" \t "_blank)  and [industrial wastewater](http://www.sswm.info/glossary/2/letteri#term1050) as long as the pollutants to be treated are  [biodegradable](http://www.sswm.info/glossary/2/letterb#term42)*.*





**Rotating Biological Contactor (RBC):**  A rotating biological contactor is a type of secondary treatment process. It consists of a series of closely spaced, parallel discs mounted on a rotating shaft which is supported just above the surface of the waste water. Microorganisms grow on the surface of the discs where [biological degradation](https://en.wikipedia.org/wiki/Biological_degradation) of the wastewater pollutants takes place. About 40% of the disc area is immersed in the wastewater. Biological growth is attached to the surface of the disc and forms a slime layer. The discs contact the wastewater with the atmospheric air for oxidation as it rotates. Thus a high degree of organic matter removal is achieved.



**Advanced Sewage Treatment:** The effluent from a typical secondary treatment plant still contains 20-40 mg/L BOD which may be objectionable in some streams. Suspended solids, in addition to contributing to BOD, may settle on the stream bed and inhibit certain forms of aquatic life.

The BOD if discharged into a stream with low flow can cause damage to aquatic life by reducing the dissolved oxygen content. In addition the secondary effluent contains significant amounts of plant nutrients and dissolved solids. If the waste water is of industrial origin, it may also contain traces of organic chemicals, heavy metals and other contaminants.

The purpose of [disinfection](https://en.wikipedia.org/wiki/Disinfection) in the treatment of waste water is to substantially reduce the number of [microorganisms](https://en.wikipedia.org/wiki/Microorganism) in the water to be discharged back into the environment for the later use of drinking, bathing, irrigation, etc. Common methods of disinfection include [ozone](https://en.wikipedia.org/wiki/Ozone), [chlorine](https://en.wikipedia.org/wiki/Chlorine), ultraviolet light, or sodium hypochlorite.

[Chlorination](https://en.wikipedia.org/wiki/Water_chlorination) remains the most common form of waste water disinfection due to its low cost and long-term history of effectiveness. One disadvantage is that chlorination of residual organic material can generate chlorinated-organic compounds that may be [carcinogenic](https://en.wikipedia.org/wiki/Carcinogenic) or harmful to the environment.

[Ultraviolet](https://en.wikipedia.org/wiki/Ultraviolet) (UV) light can be used instead of chlorine, iodine, or other chemicals. Because no chemicals are used, the treated water has no adverse effect on organisms that later consume it, as may be the case with other methods. UV radiation causes damage to the [genetic](https://en.wikipedia.org/wiki/Gene) structure of bacteria, [viruses](https://en.wikipedia.org/wiki/Virus), and other [pathogens](https://en.wikipedia.org/wiki/Pathogen), making them incapable of reproduction. The key disadvantages of UV disinfection are the need for frequent lamp maintenance and replacement and the need for a highly treated effluent to ensure that the target microorganisms are not shielded from the UV radiation.

[Ozone](https://en.wikipedia.org/wiki/Ozone) ([O](https://en.wikipedia.org/wiki/Oxygen)3) is generated by passing oxygen ([O](https://en.wikipedia.org/wiki/Oxygen)2) through a high [voltage](https://en.wikipedia.org/wiki/Voltage) potential resulting in a third oxygen [atom](https://en.wikipedia.org/wiki/Atom) becoming attached and forming [O](https://en.wikipedia.org/wiki/Oxygen)3. Ozone is very unstable and reactive and oxidizes most organic material it comes in contact with, thereby destroying many pathogenic microorganisms. Ozone is considered to be safer than chlorine because, unlike chlorine which has to be stored on site (highly poisonous in the event of an accidental release), ozone is generated on-site as needed. Ozonation also produces fewer disinfection by-products than chlorination. A disadvantage of ozone disinfection is the high cost of the ozone generation equipment and the requirements for special operators.

Sludge produced after such treatment is used as a fertilizer in the fields. However, there are chances of toxic metals and other untreated substances to build up in the food chain or leach to the ground water.

**UP flow Anaerobic Sludge Blanket (USAB) Reactor**: is a single tank process. Wastewater enters the reactor from the bottom, and flows upward. A suspended sludge blanket filters and treats the wastewater as the wastewater flows through it. This process consists of four stages of anaerobic digestion: Hydrolysis, acidogenesis, Acetogenesis, Methanogenesis.

The sludge blanket is comprised of microbial granules (1 to 3 mm in diameter), i.e., small agglomerations of microorganisms that, because of their weight, resist being washed out in the up flow. The microorganisms in the sludge layer degrade organic compounds. As a result, The above mentioned four anaerobic processes convert the influent into methane, Hydrogen, carbon dioxide, new cell matter etc. COD removal of up to 80% is achieved.

1. **What are the major sources of Soil pollution? How does it affect soil productivity and Measures taken to prevent soil pollution?**

All soils (weather polluted or un-polluted) contain a variety of compounds (contaminants) which are naturally present. Such contaminants include metals, inorganic ions and salts (e/g., phosphates, carbonates, sulfates, nitrates), and many organic compounds (such as lipids, proteins, DNA, fatty acids, hydrocarbons, PAHs, alcohols, etc.). These compounds are mainly formed through soil microbial activity and decomposition of organisms (e.g., plants and animals). Additionally, various compounds get into soil from the atmosphere (with precipitation water, as well as by wind activity or other types of soil disturbances) and from surface water bodies and shallow groundwater flowing through the soil. When the amounts of soil contaminants exceed natural levels (what is naturally present in various soils) pollution is generated. There are the following main mechanisms that generate [soil pollution](http://www.environmentalpollutioncenters.org/soil/):

## 1. Antropogenic – through human activity including:

1. **Accidental spills and leaks** during storage, transport or use of chemicals (e.g., [leaks and spills of gasoline](http://www.environmentalpollutioncenters.org/gas-stations/leaks-spills/) and diesel at gas stations);
2. **Foundry activities and manufacturing processes** that involve furnaces or other processes resulting in possible dispersion of contaminants in environment;
3. **Mining activities** involving crushing and processing of raw materials (such as mining activity);
4. [Construction activities](http://www.environmentalpollutioncenters.org/construction/)
5. **Agricultural activities** involving the spread of herbicides/pesticides/insecticides and fertilizers;
6. **Transportation activities** (e.g., vehicle emissions)
7. **Dumping of chemicals** (accidental or intended – such as illegal dumping);
8. **Storage of wastes in landfills** (which may leak to groundwater or generate polluted vapors)
9. Cracked paint chips falling from building walls, especially**lead-based paint**;

## 2. Natural

1. **Natural accumulation of compounds in soil** due to imbalances between atmospheric deposition and leaching away with precipitation water (e.g., concentration and accumulation of perchlorate in soils in arid environments)
2. **Natural production in soil under certain environmental conditions** (e.g., natural formation of perchlorate in soil in the presence of a chlorine source, metallic object and using the energy generated by a thunderstorm)
3. **Leaks from sewer lines into subsurface** (e.g., adding chlorine which could generate trihalometanes such as chloroform).

# LAND POLLUTION DISEASES

Land or **soil pollution diseases** involve those diseases caused by pollutants from the land/dirt/soil. The pollutants may enter the soil/land via:

* waste disposal (e.g., landfills);
* air deposition dry (e.g., from mining and smelting activities, foundries) and wet (e.g., acid rain);
* Contact with contaminated surface or ground waters.

The pollution of soil can affect us mainly through inhalation of gases emitted from soils moving upward and/or of fine soil particles transported by wind or which are disturbed during various human activities. Exposure to soil pollutants is in general less problematic than that to air and water pollution, it may have serious effects to children who usually play in the ground, being in closer proximity to potential pollution. Additionally, children may accidentally swallow soil particles while playing in the ground.

[Soil pollutants](http://www.environmentalpollutioncenters.org/soil/), including both chemicals and pathogens, could be in several forms - which are inter-changeable (until it reaches equilibrium):

* **Solids** – adsorbed or mixed within soil particles
* **Liquids** – filling the voids (pores) between soil particles
* **Gaseous** (soil gas) – within the air between soil particles

Soil pollution may cause a variety of health problems starting with headaches, nausea, fatigue, skin rash and/or eye irritation and potentially resulting in more serious conditions, of which, the most common soil pollution diseases include:

* Cancers, including leukemia – through soils contaminated with chemicals (e.g., gasoline, or other petroleum products containing benzene)
* Nervous system damage – caused especially by Pb in soil and affecting especially children
* Neuromuscular blockage and depression of the central nervous system
* Kidney and liver damage – caused by chemicals such as Hg

In general, many effects are common with those from [water pollution](http://www.environmentalpollutioncenters.org/water/).

Soil pollution may enter our bodies:

* **Directly** – though inhalation of soil dust or soil particles, as well as through skin contact
* **Indirectly**
  + through consumption of food (e.g., vegetables) grown on contaminated soil
  + by inhaling toxic vapors of volatile chemicals polluting the soil

|  |  |  |
| --- | --- | --- |
| **ain Soil pollutant** | **Potential Specific Sources** | **Some Common Symptoms/Effects of Poisoning with the Polluted Soil** |
| **Lead (Pb)** | Lead paint Mining Foundry activities Vehicle exhaust (historical exhaust since lead is not used in gasoline anymore) Construction activities Agriculture activities (pesticide with lead such as lead arsenate that was banned but has been historically used) | * Affect the nervous system and memory, growth and development, as well as cognitive development (lower IQs) * Learning difficulties * Autism in genetically predisposed people * Growth reduction and weight loss * Impair pituitary-thyroid endocrine system * Favor osteoporosis at old age |
| **Mercury (Hg)** | Mining Incineration of coal Alkali and metal processing Medical and other waste Volcanoes and geologic deposits (natural sources) Accumulation in plants and vegetables grown on polluted soils | * Itching, burning, pain * Damage to brain kidney and lungs * Pink disease (acrodynia) – skin discoloration (pink cheeks, fingertips, toes), while red cheeks and nose in affected chlidren * Desquamation (peeling off in layers of dead skin) * High blood pressure and hypersalivation * tachycardia   Loss of hair, teeth, nails, photofobia, kidney disfunction, memory impairment, insomnia -  in children |
| **Arsenic (As)** | Mining Coal-fired power plants Lumber facilities (used as CCA – chromate copper arsenate in pressure treated wood) Electronic Industry Foundry activities Agriculture (Pesticides - including some of those currently used) Natural accumulation under specific conditions | * If ingested –the most specific effects relates to **skin pattern changes** and **cancer**(including liver, kidney, bladder, prostate and lung cancer); also at lower doses the digestive system may be affected with symptoms such as: nausea vomiting, stomach irritation, diarrhea, damage of blood vessels   If inhaled – skin changes; irritation of throat and lungs, circulatory problems, nervous system disorders |
| **Other metals (Mn, Cd, Cu, Zn, Ni, etc.)** | Mining Foundry activities Construction activities | Depend on metals – please follow individual links |
| **PAHs (polyaromatic** | Coal burning | Harm to skin, body fluids, and |
| **hydrocarbons)** | Vehicle emissions Accumulation in plants and vegetables grown on polluted soils Cigarette smoke Wildfires Agricultural burning Wood burning Asphalt roads (construction activities) Industrial plants (e.g., coal tar, bitumen, coal-gasification) Accumulation in plants and vegetables grown on polluted soils Construction activities | * autoimmune system * Eye irritation, nausea, vomiting, diahrea * Cataracts * Kidney and liver damage * Cancer (skin, lung, bladder, gastrointestinal)   Difficulty in reproduction in animals (not yet confirmed in humans) |
| **Herbicides/ Insecticides** | Agricultural activities Gardening | **Large range of effects from skin rashes to death** |

**Control measures of Soil pollution:**

* Effluents should be properly treated before discharging them on the soil
* Solid wastes should be properly collected and disposed off by appropriate method.
* From the wastes, recovery of useful products should be made.
* Biodegradable organic waste should be used for generation of Biogas.
* Cattle dung should be used for methane generation. Night – soil (human faeces) can also be used in the biogas plant to produce inflammable methane gas.
* Microbial degradation of biodegradable substances is also one of the scientific approaches for reducing soil pollution.
  1. **GLOBAL ENVIRONMENTAL PROBLEMS & GOBAL EFFORTS**

The problems caused by pollutants such as NOx, Sox etc are now worldwide issues. Heating of earth surface; poor air quality in urban areas; the formation of acid rains, depletion of ozone layer; emission of gases are of our environmental issues which are to be studied.

**Green House Gases (GHG) & Green House Effect**: Greenhouse gases are those that canabsorb and emit infrared radiation. In order, the most abundant greenhouse gases in Earth's atmosphere are: water vapor; carbon dioxide; methane; nitrous oxide; ozone. In addition to the main greenhouse gases listed above, other greenhouse gases include sulfur hexafluoride, hydrofluorocarbons, CFC’s etc.

Chloro Fluoro Carbons are non – toxic; non-flammable contains fluorine, carbon and chlorine atoms. The five main CFCs are the:

CFC- 11 (Trichloro Fluoro Methane … CFCl3)

CFC- 12 (Dichloro Fluoro Methane … CF2Cl2)

CFC- 113 (Trichloro Tri Fluoro Ethane … C2F3Cl3)

CFC- 114 (Dichloro Tetra Fluoro ethane C2F4Cl2)

CFC-11 5 (Chloro Penta Fluoro ethane C2F5Cl)

**The major uses of CFCs** are:

1. As coolants in refrigerators (CFC 11, 12, 113,114,115);
2. In air-conditioners and in fire extinguishers (Halogen + HCFC 123);
3. as solvent in cleaning particularly electronic circuit boards (Methyl chloroform and Carbon

Tetrachloride).

1. CFC’s are used as sterilization agent in medical field (mixture of CFC12 & ethylene oxide) and propellant in aerosols like deodorants; shaving foam, perfumes etc.

Man made CFC’s however, are the main cause of stratospheric ozone depletion. CFCs have a

lifetime in the atmosphere of about 20 to 100 years and as a result one free chlorine atom from CFC molecule can do a lot of damage. Methane (CH4): The major source of methane is extraction from geological deposits known as Natural gas and used as fuel. Since it is a gas at

normal conditions, methane is distributed through pipe lines. It is also called as LNG (Liquefied Natural Gas). Methane reacts with halogens and produce Methyl Chloride (CH3Cl), Chloroform (CHCl3) and Carbon tetrachloride (CCl4).

Since the beginning of the Industrial Revolution, the burning of fossil fuels has contributed to the increase in carbon dioxide in the atmosphere from 280 ppm to 390 ppm. When these gases are ranked by their direct contribution to the greenhouse effect, the most important are:

|  |  |  |  |
| --- | --- | --- | --- |
| **Gas** | **Formula** | **Contribution (%)** | |
| Water vapor | H2O | 36 – 72 % | |
| Carbon dioxide | CO2 | 9 | – 26 % |
| Methane | CH4 | 4 | – 9 % |
| Nitrous oxides | NOx | 3 | – 7 % |
| Ozone | O3 | 3 | – 7 % |

Of these gases, CO2 accounts for about 55% of the earth’s Green House effect. Other gases are capable of changing the energy balance and causes for increase of temperature of the earth. A number of changes usually take place in the energy which comes from the sun through the atmosphere. In detail: 26% of the energy is reflected back to the space by clouds and particles whereas about 19% of the energy is absorbed by some of the gases especially ozone in the atmosphere. 4% is reflected from the surface back to space. Of the remaining 51% of the solar energy is then used in a number of process including the heating of the ground surface, evaporation of water.

**The main sources of greenhouse gases due to human activity are**:

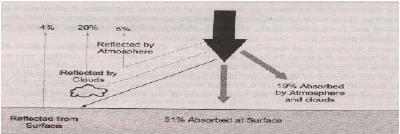
* Burning of fossil fuels and deforestation leading to higher carbon dioxide concentrations in the air.
* Use of chlorofluorocarbons (CFCs) in refrigeration systems, and use of CFCs and halogens fire suppression systems and manufacturing processes. Some halogens are used in fire

extinguishers; they in turn produce CFC’s. Hence, CFC emissions increases in the atmosphere and then causing Green House Effect .

→ Agricultural activities, including the use of fertilizers that lead to higher nitrous oxide (N2O) concentrations.

**Green House effect** is a naturally occurring process that aids the heating of the earth’s surfaceand atmosphere. Green House effect results from the gases such as CO2; CH4 (methane); N2O

(Nitrous Oxide); CFC’s; Halogens (F, Br, Cl, I) and O3. Ultimately, the Green House effect may lead to the death of both plants and animals including human beings.



**Global Warming:** Earth has become warmer over the last century. As a result of higherconcentrations of gases (especially CO2); the earth’s climate become warmer and this is referred to as Global Warming. Reports that the average climate / temperature of the earth has increased during the twentieth century by about 0.6oC (+/- 0.2oC). The IPCC (Inter-government Panel on Climate Change), a group established by the World Meteorological Organization (W M O) and The United Nations Environment Programme (UNEP) revealed the following effects of global warming:

* Global warming causes, rate of precipitation decreases on land and causes a decrease of rainfall by 40% all over the world.
* Sea level raises and low lying areas will be inundated (to cover an area of land with water)
* Global Warming change the direction of wind.
* CFC’s convert O3 into oxygen and oxygen radical and thus ozone depletes in the atmosphere.
* Global temperature will increase atleast by 4oC.
* Decrease of earth’s albedo (the amount of sun light reflection by the earth’s surface to the moon).
* People suffer from many undiagnosible diseases.
* CFC-11; 12 and 113 in the atmosphere for a longer period harmful to the human beings.

**Solutions for Global Warming**:

* By reducing the emissions of Green House gases.
* Clean electricity technologies such as wind mills/turbines; solar panels; tidal energy etc are to be used
* Bio-fuels (Ex: ethanol - a type of alcohol) and Bio-diesel could substantially cut down the CO2 emission.
* By avoiding the driving of vehicles (walking / bicycling is to be followed)

**Climate Change & their impacts on Human Environment:**

The weather conditions and seasonal variations in a region over a long period are called the average temperature in many regions has-been increasing in recent decades. Globally, 1990 was the warmest decade on record. Climatologists of the Inter-governmental Panel on Climate

changes (IPCC) have carried out several experiments in order to estimate the changes in climate. Accordingly, First Assessment Report (FAR) was completed in 1990 and Second Assessment Report (SAR) in 1997.

**Following are the main points from the climate reports:**

* The concentration of Green House Gases in the atmosphere such as CO2; Methane; Nitrous Oxide have all increased markedly since 1750 and now exceeded the levels.
* Emissions of Carbon dioxide from fossil fuel has been increased from 1990’s onwards. The

Third Assessment Report (TAR) on climate change 2001 is the most comprehensive and up-to-date scientific assessment of past, present and future climate change. The report:

* Analyses an enormous body of observations of all parts of the climate system.
* Increasing concentrations of atmospheric greenhouse gases.
* Assesses our understanding of the processes and feedbacks which govern the climate system.
* Projects related to scenarios of future climate change using a wide range of models of future emissions of greenhouse gases and aerosols. Fourth Assessment Report was released in 2007 and concluded that 90% of human beings are caused for Global Warming.
* The concentration of the Carbon Dioxide in the atmosphere (379 ppm in 2005) is higher than the past years (180 to 300 ppm) mainly due to fossil fuel usage.
* The studies have also shown that in the near future the Global surface temperature will rise by

1.4oC to 5.8oC and leads to floods and/or droughts.

* The Global mean seal level is projected to rise by 9.88 cm by the year 2100.
* The studies / reports also stated that a few regions such as NILE

**Delta:** in Egypt and Ganges–Brahmaputra delta in Bangladesh may become vulnerable (liableto be damaged). Finally, it was concluded that continued Green House Gas emissions because further Global warming and induce many changes in the Global climate system during the 21st century.

**Impacts on Human Beings:**

* Human environment will be seriously affected by extremes of climate by means of Floods and Droughts.
* Due to extreme changes in Climate, Human beings suffer from safe drinking water.
* Changes in climate may affect the distribution of vector species (Ex: mosquitoes) which in turn spread infectious diseases such as Malaria; Filariasis, Dengue, diarrhea; Yellow fever etc.
* The reduction in food production would lead to starvation.
* Climate change could lead to migration of humans.

**El Nino – LA NINA**

Oceans not only control the climate of the areas by absorbing and storing solar energy, but also distribute heat between lower and higher latitudes. The **Pacific Ocean** is the largest of the Earth's oceanic division extends from the Arctic in the north to the South of Antarctica, bounded by Asia and Australia in the west, and the US (Americas) in the east. The equator subdivides it into the **North Pacific Ocean** and **South Pacific Ocean.** Interesting examples of the interaction betweenthe oceans and the atmosphere are the **El Niño and La Niña phenomena** patterns. **El Nino** is defined by prolonged differences in Pacific Ocean surface temperatures. It is also defined as a periodic warming ie variations in the temperature in the Pacific Ocean. The accepted definition is a warming of at least 0.5 °C (0.9 °F) over the east-central Pacific Ocean. Typically, this anomaly

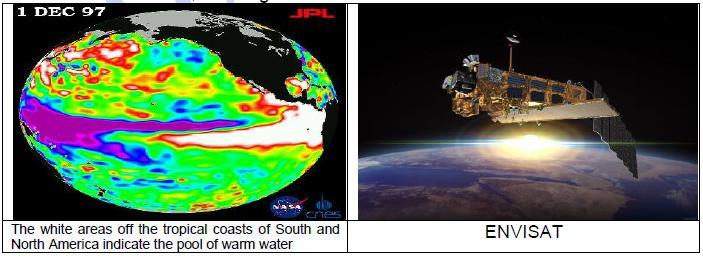
Happens at irregular intervals of 3–7 years. Because of variations in the temperature, the winds create cyclones, which is an another sign of an El Niño. The Pacific Ocean is a heat reservoir (that drives global wind patterns) and the resulting change in its temperature alters weather on a global scale.

A global wind pattern means “the region of Earth receiving the Sun's direct rays is the equator.

Here, air is heated and rises, leaving low pressure areas behind. Moving to about thirty degrees north and south of the equator, the warm air from the equator begins to cool and sink. The air movements toward the equator are called **trade winds”.**

The European Remote Sensing Satellites ERS-1 and ERS-2 measured sea surface topography continuously since July 1991. One of the areas of interest is the Pacific Ocean where the famous El Niño roars every year. This event is characterized by relatively high sea level (along the coast of Central America) accompanied by with heavy rainfall. At the same time, sea level drops in the Western Pacific ocean, where extreme droughts devastate crop yields. Envisat was launched in 2002 is the largest Earth Observation spacecraft. It carries ten sophisticated optical and radar instruments to provide continuous observation and monitoring of the Earth's land, atmosphere, oceans and ice caps. More advanced imaging radar, radar altimeter and temperature-measuring radiometer instruments extended ERS data. This is supplemented by new instruments including a medium-resolution spectrometer sensitive to both land features and ocean colour. Envisat also carries two atmospheric sensors monitoring trace gases.

The first signs of an El Nino are: Rise in surface pressure over the Indian Ocean, Indonesia and Australia Fall in air pressure in eastern Pacific Ocean Warm air near Peru, causing rain in the northern Peruvian deserts.



**LA NINA**: The results of La Niña are mostly the opposite of those of El Niño. La Niña oftencauses drought conditions in the western Pacific but flooding in northern South America; mild wet summers in northern North America, and drought in the southeastern United States. During a period of La Niña, the sea surface temperature across the equatorial Eastern Central Pacific Ocean will be lower than normal by 3–5 °C.

Ex: Singapore experienced the driest February in 2010 with 6.3 mm of rain fell in the month and temperatures hitting as high as 35 degrees Celsius. The name La Niña originates from Spanish, meaning "the girl," analogous to El Niño meaning "the boy."

**one Layer and Ozone layer depletion:**

The earth’s atmosphere is composed of several layers.

EXOSPHERE: The outer most layers extended up to 960 ms.

THERMOSPHERE: Layer extended up to 400 km from Mesosphere.

MESOSPHERE: Another layer extended up to 80km from the surface of the earth.

STROTOSPHERE: Next layer extended up to 50 km from the surface of the earth.

TROPOSPHERE: Lower layer extended up to 18 km from the surface of the earth.

**Ozone Formation**: Ozone is a form of oxygen that has three atoms in each molecule (O3).Ozone is bluish colored and highly poisons gas that has a boiling point of 112oC. At atmospheric pressure, ozone can partially dissolve in water. At standard temperature and pressure, the solubility of ozone is thirteen times that of oxygen.

Standard Temperature and Pressure**:** STP is commonly used to define standard conditions for temperature and pressure which is important for the measurements and documentation of chemical and physical processes. *STP is defined by IUPAC (International Union of Pure and* *Applied Chemistry) as air at 0oC (273.15 K, 32 oF) and 105 pascals or 100 kPa.*

Ozone is formed by the action of sunlight on oxygen. When normal oxygen absorbs solar ultra violet radiation; splitting oxygen molecules into radical oxygen (O). This atomic oxygen quickly combines with further oxygen molecules to form ozone. This action takes place naturally in the atmosphere.

|  |  |
| --- | --- |
| O2 + UV | → O + O |
| O + O2 | → O3 |

Destroy of Ozone Layer: *Two different processes destroy ozone naturally:* The first is when a free oxygen radical combines with an ozone molecule to produce two diatomic oxygen molecules.

O + O3 → 2O2

The other process when ozone molecules absorb ultraviolet radiation and form one diatomic oxygen molecule and one free oxygen radical.

O3 + UV → O + O2

**Ozone Depleting Substances (ODS)**

Ozone Depleting Substances (ODS) are those which deplete the ozone layer. The ODS’s Chloro Fluoro Carbons (CFS’s) Hydro Chloro Fluoro Carbons (HCFS’s)

Methyl Chloroform Carbon Tetrachloride and Halogens (MCCTH’s)

**Effects on human beings**:

* Ozone makes human beings eyes itch, burning sensation.
* It lowers the human body resistance power and leads to cold and pneumonia.
* Ozone reacts with tissues and cause for breathing and decrease the working ability of the lungs
* The thinning of the ozone layer may lead to an increase of skin cancers.

**Effects on Global environment**:

Certain crops may be damaged if ozone layer is depleted thus affecting natural food chains and food webs so that the ecology system disturbs. The effect of ozone depletion in Antarctica is severe; however, the ozone in the arctic region should not be neglected. Depletion of ozone causes Global warming.

* 1. **Explain International Conventions / Protocols:**

**International Conventions / Protocols:**

Convention: large formal meeting of people with the same interest or work. Protocol: The rules about what you must do and how you behave in an official situation. The objectives of the International Conventions are to stabilize the Green House Gas concentrations in the atmosphere to certain levels to prevent dangerous human interference with the climate system of the world..

**Earth Summit**: The **United Nations Conference on Environment and Development**

(UNCED), also known as the **Rio Summit**, **Rio Conference**, **Earth Summit** (Portuguese) was a major conference held in Rio de Janeiro from 3 June to 14 June 1992. Totally 172 Governments were participated with their heads and representatives, NGO’s accounting 17000 people. The issues included:

* Systematic scrutiny of patterns of production of Toxic components such as lead in gasoline.
* Alternative sources of energy to replace the use of fossil fuels which are linked to global climatic changes.
* By introducing new public transport system in order to reduce vehicle emissions in cities.
* Alarming the growing scarcity of water and has been decided to come out with proper utilization methodologies.
* Not to carry out any activities on lands that would cause environment degradation.

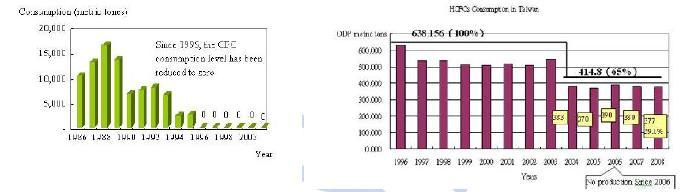
**Montreal Protocol**:

Several meetings have taken place to address the ozone layer depletion problem. The well known meeting was held in Montreal on 16-09-1987 and the agreement signed is called the Montreal Protocol, which set a timetable to phase out of CFCs as well as halogens which contain bromine and 96 harmful chemicals in the Protocol subject the schedules. The Montreal Protocol on substances that deplete the Ozone Layer is an international treaty designed to protect the ozone layer by phasing out the production of numerous substances believed to be responsible for ozone depletion. The treaty was opened for signature on September 16, 1987, and entered into force on January 1, 1989, followed by a first meeting in Helsinki (Finland), May 1989. Since then, it has undergone seven revisions, in 1990 (London), 1991 (Nairobi capital of Kenya), 1992 (Copenhagen, capital of Denmark), 1993 (Bangkok in Thailand, SE Asia), 1995 (Vienna, capital of Austria), 1997 (Montreal, Canada), and 1999 (Beijing, china). After implementing the schedules, following are the identified advantages:

**Montreal protocol**:

→ The highest calculated level of consumption of CFCs was 16,255 metric tons in 1988.

Substances were used chiefly as refrigerants, cleaning solvent, foam blowing agents and propellants in spray can. In 1996 the consumption level was reduced to zero and maintain at that level since.



* HCFCs have been used as one of the alternative substances for CFCs since 1996. As a result, consumption of HCFCs was reduced from around 630 ODP (Ozone Depletion Potential) metric tons in 1996 to 383 ODP metric tons in 2004, which indicated a 40% reduction from the baseline level.
* Without the protocol there would be a doubling effect of Ultra violet – Beta radiations reached the earth in the northern latitudes and also the amount of ozone depleting chemicals in the atmosphere would have been 5 times greater.
* It also ensured the improved scientific understanding which can be incorporated in decisions quickly.
* It is believed that if the International agreement is adhered (sticking to) the ozone layer is expected to recover by 2050.

**Kyoto Protocol**:

The Kyoto Protocol is a legally binding International agreement to reduce Green House Gas (GHG) emissions of 5.2% by the year 2012. The Protocol states that “developed countries are committed, individually or jointly to ensure that the emissions of Green House Gases do not exceed amounts assigned to each country in Annexure A to the Protocol. The agreement specifies that all countries must follow a number of statements and some of which are as follows:

* Design and implementation of climatic change mitigation (to reduce the harmful effects of something) and adoption programmes.
* Preparation of a national inventory of emission removal procedures.
* Promotion of climate friendly technology transfer.
* Accounting, reporting and review to ensure the integrity (honesty and the ability to do) of the protocol.

**10..EXPLAIN DEFORESTATION AND DESERTIFICATION:**

**Deforestation and Desertification:**

Forests are one of the most important natural resources and a part of biosphere since these are natural assets on this earth. Forests predominantly composed of trees, shrubs, woody vegetation.

Approximately 1/3rd of the earth’s total land area is covered by forests. Forests are important ecologically and economically. Ecologically forests are to be considered as earth’s lungs because they consume CO2 and release O2 which is required for sustaining the life on this earth. The poisonous gas CO2 is absorbed by the trees of forests and reduces the global warming; helps to continue hydrological cycle, reduce soil erosion…. Forest ecosystems are extremely good & hold a good quantity of water. Economically forests provide timber, fodder to grazing animals, firewood (conventional fuel), bamboos, rubbers, medicines, gums, resins, food items Deforestation refers to the loss of forest cover (or) the aimless destruction of trees . The clearing of forests across the earth has been occurring on a large scale basis for many centuries. This process involves the cutting down, burning and damaging of forests. Currently 12 million hectares of forests are cleared annually and the current rate of deforestation continues, the world’s forests will vanish within the next 100 years about 80% of the original forests on t he earth have already been cleared. Deforestation is taking place in many parts of the world for many reasons such as:

* For need of money for developing / weak countries (Malaysia cleared 3.5 million hectares of forest for rubber and oil palm plantations)
* To construct various projects
* To pay international debts if any
* To develop industries
* For making roads to access the interiors of the areas

**Effects of Deforestation**:

The removal of trees leads to soil exposure & results in soil erosion, rapid water run-off, loss of wildlife. Deforestation ---- cause unknown effects on global climate and eliminating the majority of plant and animal species on this earth. Various living beings (wildlife is diminishing) may come down resulting in imbalance of forest ecosystem.

* A variety of food products such as coffee, tea, spices, nuts, fruits etc will be reduced.
* Rainfall decreases to a great extent.
* Climatic conditions may are change.
* Historical values are lost.

**Case Studies**:

Chipko movement related to mining or quarrying opposed by Sundarlal Bahuguna in North India (refer text books for further information) Sardar Sarovar – Narmada project is a multipurpose project in Gujarat (refer text books for further information)

**Desertification**: The processes by which an area becomes even more barren, less capable ofretaining vegetation and is known as a desert. This may become a disaster in long term. Hence, desertification refers to land degradation in arid and semi-arid areas due to anthropogenic activities. Desertification often starts as patchy destruction of productive land. Increased dust particles in atmosphere also lead to desertification. The chief causes of desertification also include: Climatic factors and (ii) human factors (population growth, increased population density According to the United Nations Environmental Programme (UNEP), deforestation is an important factor contributing to desertification.

**UNIT V**

**ENVIRONMENTAL POLICY, LEGISLATION AND EIA**

* + - 1. **MULTIPLE CHOICE QUESTIONS**

1. **The Concept of sustainable development was given by (Ans: b)**
   * 1. Tansley (b) Brundtland

(c) Meadows (d) Wilson

**2. The world famous report on “The limits to growth” predicting that the world will meet the doom’s day, if growth continues limitlessly, was written by (Ans: b)**

(a) Myer’s (b) Meadows et al

(c) Brundtland (d) Wilson et al.

**3. Which one of the following is not associated with reducing the run-off loss of water? (Ans:d)**

(a)Contour cultivation (b) Chemical wetting

(c) Surface crop residues (d) Fallow soil

**4. Rain water harvesting has the following advantages. (Ans:d)**

(a) Avoids flooding of roads (b)Recharges ground water

(c) Reduces run-off loss (d) All the above

**5. Rajendra Singh of “Tarun Bharath sangh” was awarded Magsaysay Award for his work on. (Ans:a)**

(a) Water conservation (b) Social forestry

(c) Clean technology (d) Popularization of solar energy

**6. Which of the following gases has maximum contribution to enhanced green house effect?**

**(Ans: c)**

(a) CFC’s (b) CH4

(c) CO2 (d) N2O

**7. Cattle sheep and termites are responsible for the release of the following green house gas**

**(Ans: a)**

(a) Methane (b) Carbon dioxide

(c) Nitrous oxide (d) All of these

**8. The environment is a relatively new policy area of the European Union which did not acquire a sound legal basis until when? (Ans:a)**

(a)Single European Act (1987) (b) Maastricht Treaty (1993)

(C) Amsterdam Treaty (1999) (d) Lisbon Agenda (2000)

9. **The world as World Environmental day is celebrated on: (Ans: b)**

(a) December 1 (b) June 5

(c)November 14 (d) August 15

10. **The provisions for environmental protection in the constitution were made in: (Ans:a)**

**(a)** 1976 (b) 1950

(c) 1982 (d) 1960

11. **The first of the major environmental protection act to be promulgated in India was: (Ans:a)**

(a) Water Act (b) Air Act

(c) Environmental Act (d) Noise Pollution Rule

12. **The Forest (Conservation) Act was enacted in the year: (Ans: c)**

(a) 1986 (b) 1974

(c) 1980 (d) 1972

**13.The Air (Prevention and Control of Pollution) Act was enacted in the year: (Ans:a)**

(a) 1981 (b) 1996

(c) 2000 (d) 1974

**14. NGOs stands for: (Ans:a)**

(a) Non-Governmental Organization

(b) Nine-Governmental Organization

(c) Non-Gained Organizations

(d) National-Grade Organization

**15. The Environmental (Protection) Act was enacted in the year: (Ans:a)**

(a) 1986 (b) 1992

(c) 1984 (d) 1974

**16. The Forest (Conservation) Act extends to the whole of India except: (Ans:c)**

(a) Uttar Pradesh (b) Karnataka

(c) Jammu and Kashmir (d) Haryana

**17. as per the forest Act, cultivation of which of the following is a non-forest activity (Ans:d)**

(a) Tea (b) Rubber

(c) Mulberry (d) All of these

**18. Which of the following NGO’s is associated with “Chipko Movement”? (Ans: c)**

(a) Kalpavriksh (b) Srishti

(c) Dasholi Gram Swarajya Mandal (d)Green Peace.

**19. Chernobyl disaster is associated with (Ans: a)**

(a)Nuclear accident (b) Land slide

(c) Earth quake (d) Acid rain

**20. Housing affects:**

(a) Neighbourhood

(b) Energy consumption

(c) Water consumption

(d) All of the above

**21. The human activity, among the following, which causes maximum environmental pollution having regional and global impacts, is:**

(a) Urbanization

(b) Industrialisation

(c) Agriculture

(d) Mining

**22.Production, transformation and use of energy are the major problems of:**

(a) Industrial activity

(b) Sustainable development

(c) Global warming

(d) Acid rain

**23.A chemical industry is not a cause of:**

(a) Air pollution

(b) Noise pollution

(c) Water pollution

(d) Nuclear pollution

**24.Electronic waste is the adverse effect of:**

(a) Industry

(b) Agriculture

(c) Housing

(d) Mining

**25.Extraction of mineral and metal form the earth is:**

(a) Agriculture

(b) Transportation

(c) Mining

(d) Sustainable development

**26.Underground and open caste is the methods of:**

(a) Agriculture

(b) Mining

(c) Housing

(d) Transportation

**27. This is not the effect of transportation:**

(a) Air emission

(b) Material consumption

(c) Solid waste generation

(d) Acid mine drainage

**28. In EIA the decision to hold hearing has to made within:**

(a) 5 days

(b) 10 days

(c) 20 days

(d) 30 days

**29. SPCB’s are required to give notice in how many newspapers mentioning the date, time and place of public hearing:**

(a) 2

(b) 4

(c) 6

(d) 8

**30. ‘Meeting the needs of the present without compromising the ability of future generation to meet their own need’ is given by:**

(a) Brundtland

(b) Mahatma Gandhi

(c) Maathai

(d) Sunderlal Bahugana

**31. The idea of sustainable development was conceived in early:**

(a) 1950

(b) 1960

(c) 1970

(d) 1980

**32. How many agreement are there in Agenda – 21?**

(a) 4

(b) 5

(c) 6

(d) 7

**33. Sustainable development will not aim at:**

(a)Social economic development which optimise the economic and societal benefits available in the present, without spoiling the likely potential for similar benefits in the future

(b)Reasonable and equitable distributed level of economic well being that can be perpetuated continually

(c)Development that meets the need of the present without compromising the ability of future generation to meet their own needs

(d)Maximising the present day benefits through increased resource consumption

**34. Which of the following statements in relation to sustainable development is not true?**

(a) Sustainable development is defined as the development that meets the needs of present without compromising the ability of our future generations to meet their own needs

(b) Sustainability has the main objective of purely focussing on the natural environment

(c) Sustainable development of various countries and the entire world is the only solution left with mankind to survive for a longer period on Earth

(d)Sustainable development not only considers the protection of the environment but also the maintenance of economic viability as well as the social and ethical considerations

**35. The maximum number of individuals that can be supported by a given environment is called**

(a) Biotic potential

(b) Carrying capacity

(c) Environmental resistance

(d) Population size

**36. Supporting capacity and assimilative capacity are the components of**

(a) Carrying capacity

(b) Holding capacity

(c) Containing capacity

(d) Capturing capacity

**37. Social, economical and ecological equity is the necessary condition for achieving**

(a) Social development

(b) Economical development

(c) Sustainable development

(d) Ecological development

**38.Agricultural activity such as tilling, harvesting, heating and ventilation are direct consumes of:**

(a) Energy

(b) Air

(c) Sun

(d) Heat

39. **Housing affects:**

(a) Neighbourhood

(b) Energy consumption

(c) Water consumption

(d) All of the abo

**40. Which of the following is not the effect of modern agriculture?**

(a) Nitrate pollution

(b) Eutrophication

(c) Biomagnification

(d) Ozone depletion

**II.SHORT ANSWER TYPE QUESTIONS:**

**1.Define EIA?**

Ans: EIA stands for Environmental Impact Assessment. It is used to find the project impacts. It includes two types 1. Rapid Eia and 2. Comprehensive Eia .Rapid EIA takes only 3 months whereas Comprehensive EIA takes more than a year to complete the assessment.

**2. Air act 1981?**

Ans: This Act mainly talks about preserving the good quality of air. It includes sec 19 and 20.

**3. Forest Act 1980?**

Ans: This act enables us to protect the Animals. It includes sec 29, 33,35.

**4. Bio-medical waste management 1998?**

Ans: Bio-medical waste is defined as the waste coming from labs, veterinary colleges and hospitals etc.

**5. Hazardous waste management 1989?**

Ans: Hazardous waste management is termed as the waste which is harmful to human health and to the environment.

**6. Sustainability?**

Ans:It is defined as using the resources in a wise manner such that it will be useful to present and future generations.

**7. Green building concept?**

Ans: Green building refers to a building which does not have any negative impacts on environment.

**8. Crazy consumerism?**

Ans: It refers to a philosophy of rendering services to ‘n’ number of consumer’s in order to satisfy their diversified needs. It is of two types 1. Ineffective and 2. Effective consumerism

**9. Expand the following?**

IGBC-Indian Green Building Council.

LEED-Leadership in energy and environment design

TERI-The energy and resource institute

GRIHA-Green rating for integrated habitat assessment

BEE-Bureau of energy efficiency

**10. What is Low carbon life style?**

Ans: Low carbon life means a kind of life style in which people do their best to reduce energy consumption and green house gases.

**11. What is life cycle assessment?**

Ans: Life cycle assessment is a cradle to grave approach. Cradle to grave begins with the gathering of raw materials from the earth to create the product and ends at the points when the material returned to earth.it includes 4 stages: 1. Goal scoping and definitions 2. Inventory Analysis 3.Impact assessment and 4. Interpreter.

**12. Ecological foot print?**

Ans: It represents the amount of biologically productive land and sea area necessary to supply the resources a human population consumes, and to assimilate associated waste.

**13. Desertification?**

Ans: Degradation of existing vegetation to form a desert. This happens due to deforestation, overgrazing etc.

**14. Habitat?**

Ans: The native environment where a plant or an animal naturally lives.

**15. Algal bloom?**

Ans: Algae seen as an explosion of colour on the water surfaces-orange, red or brown. Algal blooms reduce the amount of oxygen in lakes and rivers and results in the death of aquatic organisms.

**16. Biological oxygen demand?**

Ans: The amount of dissolved oxygen required for the biological oxidation of organic matters under aerobic conditions at 20 c for a period of five days.

17. Chemical oxygen demand?

The determination of COD is used in municipal and industrial laboratories to measure the overall level of organic contamination in waste water. The contamination level is determined by measuring the equivalent amount of oxygen required to oxidize organic matter in the sample

**17. Biome?**

Ans: Terrestrial regions inhabitated by certain types of life, especially vegetation (grass). Ex: deserts, grasslands and forests.

**18. Ambient air?**

Ans: The air that surrounds us is defined as ambient air.

**III.ESSAY TYPE QUESTIONS:**

* + - * 1. **Explain Environmental Protection Act,**
* This Act may be called the Environment (Protection) Act, 1986.
* (2) It extends to the whole of India.
* (3) It shall come into force on such date as the Central Government may, by notification in the Official Gazette, appoint and different dates may be appointed for different provisions of this Act and for different areas.1
* **2.DEFINITIONS**
* In this Act, unless the context otherwise requires,--
* (a) "environment" includes water, air and land and the inter- relationship which exists among and between water, air and land, and human beings, other living creatures, plants, micro-organism and property;
* (b) "environmental pollutant" means any solid, liquid or gaseous substance present in such concentration as may be, or tend to be, injurious to environment;
* (c) "environmental pollution" means the presence in the environment of any environmental pollutant;
* (d) "handling", in relation to any substance, means the manufacture, processing, treatment, package, storage, transportation, use, collection, destruction, conversion, offering for sale, transfer or the like of such substance;
* (e) "hazardous substance" means any substance or preparation which, by reason of its chemical or physico-chemical properties or handling, is liable to cause harm to human beings, other living creatures, plant, micro-organism, property or the environment;
* (f) "occupier", in relation to any factory or premises, means a person who has, control over the affairs of the factory or the premises and includes in relation to any substance, the person in possession of the substance;
* (g) "Prescribed" means prescribed by rules made under this Act.
* **RULES TO REGULATE ENVIRONMENTAL POLLUTION**
* (1) The Central Government may, by notification in the Official Gazette, make rules in respect of all or any of the matters referred to in section 3.
* (2) In particular, and without prejudice to the generality of the foregoing power, such rules may provide for all or any of the following matters, namely:--
* (a) the standards of quality of air, water or soil for various areas and purposes
* (b) the maximum allowable limits of concentration of various environmental pollutants (including noise) for different areas;
* (c) the procedures and safeguards for the handling of hazardous substances
* (d) the prohibition and restrictions on the handling of hazardous substances in different areas;
* (e) the prohibition and restriction on the location of industries and the carrying on process and operations in different areas;
* (f) the procedures and safeguards for the prevention of accidents which may cause environmental pollution and for providing for remedial measures for such accidents.

1. **EXPLAIN AIR ACT-1981. WATER ACT**

**Air Prevention and Control of Pollution Act (1981) of India**

The Act specifically empowers State Government to designate air pollution areas and to prescribe the type of fuel to be used in these designated areas. According to this Act, no person can operate certain types of industries including the asbestos, cement, fertilizer and petroleum industries without consent of the State Board.

his Act is created to take appropriate steps for the preservation of the natural resources of the Earth which among other things includes the preservation of high quality air and ensures controlling the level of air pollution.

**The main objectives of the Act are as follows:**

(a) To provide for the prevention, control and abatement of air pollution.

(b) To provide for the establishment of central and State Boards with a view to implement the Act.

c) To confer on the Boards the powers to implement the provisions of the Act and assign to the Boards functions relating to pollution.

Air pollution is more acute in heavily industrialized and urbanized areas, which are also densely populated. The presence of pollution beyond certain Limits due to various pollutants discharged through industrial emission is monitored by the PCBs set up in every state.

### Powers and Functions of the Boards:

#### Central Pollution Board:

The main function of the Central Board is to implement legislation created to improve the quality of air and to prevent and control air pollution in the country.

The-Board advises the Central Government on matters concerning the improvement of air quality and also coordinates activities, provides technical assistance and guidance to State Boards and lays down standards for the quality of air. It collects and disseminates information in respect of matters relating to air pollution and performs functions as prescribed in the Act.

#### State Pollution Control Boards:

The State Boards have the power to advise the State Government on any matter concerning the prevention and control of air pollution. They have the right to inspect at all reasonable times any control equipment, industrial plant, or manufacturing process and give orders to take the necessary steps to control pollution.

**Penalties:**

The persons managing industry are to be penalized if they produce emissions of air pollutants in excess of the standards laid down by the State Board. The Board also makes applications to the court for restraining persons causing air pollution.

Whoever contravenes any of the provision of the Act or any order or direction issued is punishable with imprisonment for a term which may extend to three months or with a fine of Rs. 10,000 or with both, and in case of continuing offence with an additional fine which may extend to Rs 5,000 for every day during which such contravention continues after conviction for the first contravention.

**WATER ACT 1974:**

The act aims to prevent and control water pollution and to maintain/restore wholesomeness of water by establishing central and state pollution control board to monitor and enforce the regulations

The Central Pollution Control Board, and State Pollution Control Boards composition, terms and conditions of service of members are defined in Sections 3-12 of water (prevention and control of pollution) act, 1974.

The Board advises the government on any matter concerning the prevention and control of water pollution. It coordinates the activities and provides technical assistance and guidance. This policy sets the standards and penalties for non-compliance for polluting bodies.

The Government has power to restrict any unit, and to take samples of effluents and get them analysed in Central or State laboratories. Whoever fails to comply with any provision of this Act is punishable with imprisonment, fine or with both.

The Central Board may perform all or any of the following functions, namely,-

* advise the Central Government on any matter concerning the prevention and control of water pollution;
* co-ordinate the activities of the State Boards and resolve disputes among them;
* provide technical assistance and guidance to the State Boards, carry out and sponsor investigations and research relating to problems of water pollution and prevention, control or abatement of water pollution;
* plan and organise the training of persons engaged or to be engaged in programmes for the prevention, control or abatement of water pollution on such terms and conditions as the Central Board may specify;
* organise through mass media a comprehensive programme regarding the prevention and control of water pollution;
* collect, compile and publish technical and statistical data relating to water pollution and the measures devised for its effective prevention and control and prepare manuals, codes or guides relating to treatment and disposal of sewage and trade effluents and disseminate information connected therewith;
* lay down, modify or annul, in consultation with the State Government concerned, the standards for a stream or well;
* plan and execute a nation-wide programme for the prevention, control or abatement of water pollution;
* perform such other functions as may be prescribed.

**3. EXPLAIN FOREST ACT, WILD LIFE ACT**

**THE FOREST CONSERVATION ACT:** The Forest Conservation Act was passed in 1980 to provide for the conservation of forests and tor matters connected therewith. The Act extends in whole of India except the State of Jammu & Kashmir and is in force from 25th October 1980.

The Act which was subsequently amended in 1988 (69 of 1988) have the following sections:

1. Extent and commencement.

2. Restriction on the conservation of forests of use of forest land for non-forest purpose.

3. Constitution of advisory committee.

(A) Penalty for conservation of Act.

(B) Offences by authorities and government departments.

4. Power to make rules.

5. Repeal and saving.

Sections 3 (A) and 3 (B) were added through the amendments of 1988, which deal with penalty for conservation of the provisions of the Act and offences by authorities and Government Department, respectively.

Salient Features of the Act: The Forest Conservation Act was enacted with a view to check further deforestation, which ultimately results in ecological imbalances, accordingly the provisions made therewith must apply to all forest irrespective of the nature of ownership for classification thereof.

he world forest covers all statutorily recognized forests whether designated as reserved, protected or otherwise for Section 2 (i) of the Act. The term forest land included any area recorded as forest in the Government record irrespective of the ownership.

The salient features of the Act are as follows:

1. The act places restrictions on the power of the State Government concerning preservation of forests or use of forest land for non-forest purposes. Section 2 of the Act provides that the State Government shall not make amendments except with the prior approval of the Central Government or any order directing thereon:

(i) That any reserved forest or any portion thereof, shall cease to be reserved.

(ii) That any forest land or any portion thereof may be used for any non-forest purpose.

(iii) That any forest land or any portion thereof may be assigned by way of lease of otherwise to any private person or non-Government body.

(iv) That any forest or any portion thereof may be cleared of trees which have grown naturally in that land for the purpose of using it for reforestation.

2. The Act provides for the constitution of advisory committee to advise the Government with regard to the grant of approved by the Central Government (Sec. 2) or any other matter connected with conservation of forests which may be referred to it by the Central Government (Sec.3)

3. As per Section 2 of the Act, all ongoing non-forest activities within any forest, in any State throughout the country, without prior approval of the Centre, must cease forthwith.

4. On violation of the provision of Section 2, the offender shall be punishable with imprisonment for a period extending to 15 days (Section 3-A). Any government department or any authority deemed to be guilty of the offence shall be liable to be proceeded against and punished accordingly.

5. The amendment of 1988 shattered all the expectations of tribal communities and many voluntary agencies placed all the forest land under the jurisdiction of the forest department.

For the purpose of section 2 of the Act, non-forest purpose means the breaking up or clearing of any forest land or portion thereof for:

(a) The cultivation of tea, coffee, spices, rubber, palms, oil-bearing plant, horticulture crops or medicinal plants.

(b) Any purpose other than reforestation, but does not include any work relating to ancillary conservation, development and management of forest and wildlife, namely, the establishment of check posts, fire-lines, wireless communication and construction of fencing, bridges and culverts, dams, waterholes, trench marks, boundary marks, pipelines or other like purposes.

In conclusion the forest should be looked upon as a source of revenue. Forests are renewable natural sources.

**WILD LIFE ACT (1972):**

**1. Short title, extent and commencement.—**

[(1)](https://indiankanoon.org/doc/948261/) This Act may be called the Wild Life (Protection) Act, 1972. 1[(2) It extends to the whole of India except the State of Jammu and Kashmir.]

[(3)](https://indiankanoon.org/doc/428271/) It shall come into force in a State or Union territory to which it extends, 2[\*\*\*] on such date as the Central Government may, by notification, appoint, and different dates may be appointed for different provisions of this Act or for different States or Union territories.

**2. Definitions.—In this Act, unless the context otherwise requires,— 1[**

* + 1. “animal” includes mammals, birds, reptiles, amphibians, fish, other chordates and invertebrates and also includes their young and eggs;]

[(2)](https://indiankanoon.org/doc/1375176/) “animal article” means an article made from any captive animal or wild animal, other than vermin, and includes an article or object in which the whole or any part of such animal 2[has been used, and ivory imported into India and an article made therefrom]; 3[\*\*\*] 4[(4) “Board” means a State Board for Wild Life constituted under sub-section (1) of section 6;]

[(5)](https://indiankanoon.org/doc/1387281/) “captive animal” means any animal, specified in Schedule I, Schedule II, Schedule III or Schedule IV, which is captured or kept or bred in captivity; 5[\*\*\*]

[(7)](https://indiankanoon.org/doc/131226/) “Chief Wild Life Warden” means the person appointed as such under clause (a) of sub-section (1) of section 4; 6[(7A) “circus” means an establishment, whether stationary or mobile, where animals are kept or used wholly or mainly for the purpose of performing tricks or manoeuvres;] 7[\*\*\*] 8[(9) “Collector” means the chief officer-in-charge of the revenue administration of a district or any other officer not below the rank of a Deputy Collector as may be appointed by the State Government under section 18B in this behalf;]

[(10)](https://indiankanoon.org/doc/363095/) “commencement of this Act”, in relation to—

[(a)](https://indiankanoon.org/doc/1252449/) a State, means commencement of this Act in that State,

[(b)](https://indiankanoon.org/doc/103284/) any provision of this Act, means the commencement of that provision in the concerned State; 9[(11) “dealer” in relation to any captive animal, animal article, trophy, uncured trophy, meat or specified plant, means a person, who carries on the business of buying or selling any such animal or article, and includes a person who undertakes business in any single transaction;]

[(12)](https://indiankanoon.org/doc/470268/) “Director” means the person appointed as Director of Wild Life Preservation under clause (a) of sub-section (1) of section 3; 10[(12A) “Forest officer” means the Forest officer appointed under clause (2) of section 2 of the Indian Forest Act, 1927 (16 of 1927) or under any other Act for the time being in force in a State;] 11[(12B) “forest produce” shall have the same meaning as in sub-clause (b) of clause (4) of section 2 of the Indian Forest Act, 1927 (16 of 1927);] 12[\*\*\*]

[(14)](https://indiankanoon.org/doc/1635521/) “Government property” means any property referred to in section 39; 6[or section 17H;]

[(15)](https://indiankanoon.org/doc/142741122/) “habitat” includes land, water or vegetation which is the natural home of any wild animal;

[(16)](https://indiankanoon.org/doc/28408395/) “hunting”, with its grammatical variations and cognate expressions, includes,— 13[(a) killing or poisoning of any wild animal or captive animal and every attempt to do so;

[(b)](https://indiankanoon.org/doc/153936769/) capturing, coursing, snaring, trapping, driving or baiting any wild or captive animal and every attempt to do so;]

[(c)](https://indiankanoon.org/doc/56487236/) injuring or destroying or taking any part of the body of any such animal or, in the case of wild birds or reptiles, damaging the eggs of such birds or reptiles, or disturbing the eggs or nests of such birds or reptiles;

[(17)](https://indiankanoon.org/doc/101332691/) “land” includes canals, creeks and other water channels, reservoirs, rivers, streams and lakes, whether artificial or natural, 14[marshes and wetlands and also includes boulders and rocks];

[(18)](https://indiankanoon.org/doc/49064277/) “licence” means a licence granted under this Act; 15[(18A) “livestock” means farm animals and includes buffaloes, bulls, bullocks, camels, cows, donkeys, goats, sheep, horses, mules, yaks, pigs, ducks, geese, poultry and their young but does not include any animal specified in Schedules I to V;] 16[(19) “manufacturer” means a person who manufactures articles from any animal or plant specified in Schedules I to V and VI, as the case may be;

[(20)](https://indiankanoon.org/doc/77772695/) “meat” includes blood, bones, sinew, eggs, shell or carapace, fat and flesh with or without skin, whether raw or cooked, of any wild animal or captive animal, other than a vermin;

[(20A)](https://indiankanoon.org/doc/166771670/) “National Board” means the National Board for Wild Life constituted under section 5A;]

[(21)](https://indiankanoon.org/doc/51255539/) “National Park” means an area declared, whether under section 35 or section 38, or deemed, under sub-section (3) of section 66, to be declared, as a National Park;

[(22)](https://indiankanoon.org/doc/162067529/) “notification” means a notification published in the Official Gazette;

[(23)](https://indiankanoon.org/doc/178101200/) “permit” means a permit granted under this Act or any rule made thereunder;

[(24)](https://indiankanoon.org/doc/29858520/) “person” includes a firm; 17[(24A) “protected area” means a National Park, a sanctuary, a conservation reserve or a community reserve notified under sections 18, 35, 36A and 36C of the Act;]

[(25)](https://indiankanoon.org/doc/71156293/) “prescribed” means prescribed by rules made under this Act; 18[(25A) “recognised zoo” means a zoo recognised under section 38H;] 19[(25B) “reserve forest” means the forest declared to be reserved by the State Government under section 20 of the Indian Forest Act, 1927 (16 of 1927), or declared as such under any other State Act;] 20[(26) “sanctuary” means an area declared as a sanctuary by notification under the provisions of Chapter IV of this Act and shall also include a deemed sanctuary under sub-section (4) of section 66;] 21[(27) “specified plant” means any plant specified in Schedule VI;] 22[\*\*\*]

[(29)](https://indiankanoon.org/doc/134551779/) “State Government”, in relation to a Union territory, means the Administrator of that Union territory appointed by the President under article 239 of the Constitution; 23[(30) “taxidermy”, with its grammatical variations and cognate expressions, means the curing, preparation or preservation or mounting of trophies;] 24[(30A) “territorial waters” shall have the same meaning as in section 3 of the Territorial Waters, Continental Shelf, Exclusive Economic Zone and other Maritime Zones Act, 1976 (80 of 1976);]

[(31)](https://indiankanoon.org/doc/118481717/) “trophy” means the whole or any part of any captive animal or wild animal, other than vermin, which has been kept or preserved by any means, whether artificial or natural, and includes—

[(a)](https://indiankanoon.org/doc/15561995/) rugs, skins and specimens of such animal mounted in whole or in part through a process of taxidermy, and 25[(b) antler, bone, carapace, shell, horn, rhinoceros horn, hair, feather, nail, tooth, tusk, musk, eggs, nests and honeycomb;]

[(32)](https://indiankanoon.org/doc/143093810/) “uncured trophy” means the whole or any part of any captive animal or wild animal, other than vermin, which has not undergone a process of taxidermy, and includes a 26[freshly killed wild animal, ambergris, musk and other animal products];

[(33)](https://indiankanoon.org/doc/176901389/) “vehicle” means any conveyance used for movement on land, water or air and includes buffalo, bull, bullock, camel, donkey, elephant, horse and mule;

[(34)](https://indiankanoon.org/doc/116714029/) “vermin” means any wild animal specified in Schedule V;

[(35)](https://indiankanoon.org/doc/81169401/) “weapon” includes ammunition, bows and arrows, explosives, firearms, hooks, knives, nets, poison, snares and traps and any instrument or apparatus capable of anaesthetizing, decoying, destroying, injuring or killing an animal; 27[(36) “wild animal” means any animal specified in Schedules I to IV and found wild in nature;] 28[(37) “wild life” includes any animal, aquatic or land vegetation which forms part of any habitat;]

[(38)](https://indiankanoon.org/doc/149175596/) “Wild Life Warden” means the person appointed as such under clause (b) of sub-section (1) of section 4; 29[(39) “zoo” means an establishment, whether stationary or mobile, where captive animals are kept for exhibition to the public 30[and includes a circus and rescue centres but does not include an establishment].]

3. Procedure to be followed by the Board.—

[(1)](https://indiankanoon.org/doc/315781/) The Board shall meet at least twice a year at such place as the State Government may direct.

[(2)](https://indiankanoon.org/doc/30222/) The Board shall regulate its own procedure (including the quorum).

[(3)](https://indiankanoon.org/doc/64899/) No act or proceeding of the Board shall be invalid merely by reason of the existence of any vacancy therein or any defect in the constitution thereof or any irregularity in the procedure of the Board not affecting the merits of the case.

**4.EXPLAIN MUNICIPAL SOLID WASTE MANAGEMENT AND HANDLING RULE**

### Municipal Solid Wastes

### Municipal solid waste includes commercial and domestic wastes generated in municipal or notified areas in either solid or semi-solid form excluding industrial hazardous wastes but including treated bio-medical wastes.

### Collection of municipal solid wastes

Littering of municipal solid waste shall be prohibited in cities, towns and in urban areas notified by the State Governments. To prohibit littering and facilitate compliance, the following steps shall be taken by the municipal authority, namely

* Organizing house-to-house collection of municipal solid wastes through any of the methods, like community bin collection (central bin), house-to-house collection, collection on regular pre-informed timings and scheduling by using musical bell of the vehicle.
* Devising collection of waste from slums and squatter areas or localities including hotels, restaurants, office complexes and commercial areas.
* Wastes from slaughter houses, meat and fish markets, fruits and vegetable markets, which are biodegradable in nature, shall be managed to make use of such wastes.
* Bio-medical wastes and industrial wastes shall not be mixed with municipal solid wastes and such wastes shall follow the rules separately specified for the purpose.
* Collected waste from residential and other areas shall be transferred to community bin by hand-driven carts or other small vehicles.
* Construction or demolition wastes or debris shall be separately collected and disposed off following proper norms. Similarly, wastes generated at dairies shall be regulated in accordance with the State laws.
* Waste (garbage, dry leaves) shall not be burnt.
* Stray animals shall not be allowed to move around waste storage facilities or at any other place in the city or town.

### Storage of municipal solid wastes

Municipal authorities shall establish and maintain storage facilities in such a manner, as they do not create unhygienic and unsanitary conditions around it. Following criteria shall be taken into account while establishing and maintaining storage facilities, namely:

* Storage facilities shall be created and established by taking into account quantities of waste generation in a given area and the population densities. A storage facility shall be so placed that it is accessible to users.
* Storage facilities to be set up by municipal authorities or any other agency shall be so designed that wastes stored are not exposed to open atmosphere and shall be aesthetically acceptable and user-friendly.
* Storage facilities or ‘bins’ shall have ‘easy to operate’ design for handling, transfer and transportation of waste. Bins for storage of bio-degradable wastes shall be painted green, those for storage of recyclable wastes shall be painted white and those for storage of other wastes shall be painted black.
* Manual handling of waste shall be prohibited. If unavoidable due to constraints, manual handling shall be carried out under proper precaution with due care for safety of workers.

**Processing of municipal solid wastes**

Municipal authorities shall adopt suitable technology or combination of such technologies to make use of wastes so as to minimize burden on landfill. Following criteria shall be adopted, namely

* The biodegradable wastes shall be processed by composting, vermicomposting, anaerobic digestion or any other appropriate biological processing for stabilization of wastes.
* Mixed waste containing recoverable resources shall follow the route of recycling.
* Incineration with or without energy recovery can also be used for processing wastes in specific cases.

Municipal authority or the operator of a facility wishing to use other state-of-the-art technologies shall approach the Central Pollution Control Board to get the standards laid down before applying for grant of authorization.

### Disposal of municipal solid wastes

Land filling shall be restricted to non-biodegradable, inert waste and other waste that are not suitable either for recycling or for biological processing. Land filling shall also be carried out for residues of waste processing facilities as well as pre-processing rejects from waste processing facilities. Land filling of mixed waste shall be avoided unless the same is found unsuitable for waste processing. Under unavoidable circumstances or till installation of alternate facilities, land filling shall be done following proper norms.

### Managing Non-biodegradable solid waste (NBDSW)

Non-biodegradable solid waste (NBDSW) or refuse is a carpet word. It covers a variety of materials ranging from asbestos to Zinc batteries. Polythene and its related compounds are the most commonly found solid waste materials in urban environs. Many non-biodegradable solid waste materials are known to cause considerable environmental hazards when released into land, water and atmosphere.

### Coastal environment and social waste management

Solid waste related problems prevail more in megalopolis and the dangers reach great heights in coastal cities. Solid wastes of domestic and industrial units are considered major pollutants of coastal regions of India.

### Waste Management at source

|  |  |
| --- | --- |
| **Source of waste generation** | **Action to be taken** |
| Household | • Not to throw any solid waste in the neighbourhood, on the streets, open spaces, and vacant lands, into the drains or water bodies           • Keep food waste/biodegradable waste in a non corrosive container with a cover (lid)        Keep dry, recyclable waste in a bin or bag or a sack             • Keep domestic hazardous waste if and when generated separately for disposal at specially notified locations |
| Multi-storeyed buildings commercial complexes private societies | • Provide separate community bin or bins large enough to hold food/biodegradable waste and recyclable waste generated in the building or society. • Direct the members of the association to deposit their waste in community bin |
| Slums | • Use community bins provided by local body for deposition of food and biodegradable waste |
| Shops, offices, institutions, etc | • If situated in a commercial complex, deposit the waste in bins provided by the association |
| Hotels & restaurants | • The container used should be strong, not more than 100 litre in size, should have a handle on the top or handles on the sides and a rim at the bottom for easy handling |
| Vegetable & Fruit Markets | • Provide large containers, which match with transportation system of the local body.  • Shop keepers not to dispose of the waste in front of their shops or open spaces.     Deposit the waste as and when generated into the large container placed in the market. |
| Meat & fish markets | • Not to throw any waste in front of their shops or open spaces around. Keep non-corrosive container/containers not exceeding 100-litre capacity with lid handle and the rim at the bottom and deposit the waste in the said containers as and when generated.  • Transfer the contents of this container into a large container provided by the association |
| Street food vendors | • Not to throw any waste on the street, pavement or open spaces. Keep bin or bag for the storage of waste that generates during street vending activity        • Preferably have arrangements to affix the bin or bag with the hand–cart used for vending. |
| Marriage halls, community halls, kalyanamandapas | • Not to throw any solid waste in their neighbourhood, on the streets, open spaces, and vacant lands, into the drains or water bodies.  • Provide a large container with lid which may match with the transportation system of the local body and deposit all the waste generated in the premises in such containers. |
| Hospitals, Nursing homes, etc | • Not to throw any solid waste in their neighbourhood, on the streets,open spaces, and vacant lands, into the drains or water bodies.      • Not to dispose off the biomedical waste in the municipal dust bins or other waste collection or storage site meant for municipal solid waste.        • Store the waste as per the directions contained in the government of India, Ministry of Environment Biomedical Waste (Management & Handling) Rules, 1998. |
| Construction/ demolition waste | • Not to deposit construction waste or debris on the streets, footpaths, pavements, open spaces, water bodies etc.        Store the waste within the premises or with permission of the authorities just outside the premises without obstructing the traffic preferably in a container if available through the local body or private contractors |
| Garden waste | • Compost the waste within the garden, if possible Trim the garden waste once in a week on the days notified by the local body.          • Store the waste into large bags or bins for handing over to the municipal authorities appointed for the purpose on the day of collection notified. |

#### Some items that can be recycled or reused

**Paper**

* Old copies
* Old books
* Paper bags
* Newspapers
* Old greeting cards
* Cardboard box

**Plastic**

* Containers
* Bags
* Sheets

**Glass and ceramics**

* Bottles
* Plates
* Cups
* Bowls

**Miscellaneous**

* Old cans
* Utensils
* Clothes
* Furniture

### Role of NGOs

During the recent years, NGOs (non-governmental organizations) have taken up initiatives to work with local residents to improve sanitation. They have been playing an active role in organizing surveys and studies in specified disciplines of social and technological sciences. In the field of garbage management, such studies are useful in identifying areas of commercial potentials to attract private entrepreneurs. They can play an important role in segregation of waste, its collection and handling over to local authorities.

They are all successfully creating awareness among the citizens about their rights and responsibilities towards solid waste and the cleanliness of their city. These organizations promote environmental education and awareness in schools and involve communities in the management of solid waste.

**Occupational hazards associated with waste handling Infections**

* Skin and blood infections resulting from direct contact with waste, and from infected wounds.
* Eye and respiratory infections resulting from exposure to infected dust.
* Different diseases that results from the bites of animals feeding on the waste.
* Intestinal infections that are transmitted by flies feeding on the waste.

**Role of Pollution Control Boards**

Since the disposal of municipal solid wastes poses problems of the pollution and health hazards, the Pollution Control Boards are expected to take action for persuading the civic authorities in proper management of municipal solid wastes. Though, direct responsibility of management of solid wastes is on the local municipal authorities, the Pollution Control Boards need to have close linkage with local authorities in rendering assistance in terms of carrying out necessary surveys and providing technological back-up. The Central Pollution Control Board and the State Pollution Control Boards at the national and state levels are to disseminate information and create awareness among the concerned authorities and public at large.

**Action Taken**

The Central Pollution Control Board (CPCB) and the State Pollution Control Boards (SPCBs) within the given powers to them under relevant Acts and Rules have been attempting to persuade local bodies to take appropriate measures for the treatment and disposal of domestic sewage and municipal solid waste.

* 1. **EXPLAIN BIOMEDICAL WASTE MANAGEMENT**

All human activities produce waste. We all know that such waste may be dangerous and needs safe disposal. Industrial waste, sewage and agricultural waste pollute water, soil and air. It can also be dangerous to human beings and environment. Similarly, hospitals and other health care facilities generate lots of waste which can transmit infections, particularly HIV, Hepatitis B & C and Tetanus, to the people who handle it or come in contact with it.

India generates around three million tonnes of medical wastes every year and the amount is expected to grow at eight per cent annually.

### Types of Bio-medical waste

Bio-medical waste means “any solid and/or liquid waste including its container and any intermediate product, which is generated during the diagnosis, treatment or immunization of human beings or animals or research activities pertaining thereto or in the production or testing of biological or in health camps.Biomedical waste poses hazard due to two principal reasons – the first is infectivity and other toxicity.

**Bio Medical waste consists of**

* Human anatomical waste like tissues, organs and body parts
* Animal wastes generated during research from veterinary hospitals
* Microbiology and biotechnology wastes
* Waste sharps like hypodermic needles, syringes, scalpels and broken glass
* Discarded medicines and cytotoxic drugs
* Soiled waste such as dressing, bandages, plaster casts, material contaminated with blood, tubes and catheters
* Liquid waste from any of the infected areas
* Incineration ash and other chemical wastes

The biomedical waste (BMW) management requires its categorisation as a first step. The BMW Rules classify the BMW into following categories.

|  |  |  |  |
| --- | --- | --- | --- |
| **CATEGORIES OF BIOMEDICAL WASTE SCHEDULE – I** | | | |
| **CATEGORY** | **TYPE OF WASTE** | **TYPE OF BAG OR CONTAINER TO BE USED** | **TREATMENT AND DISPOSAL OPTION** |
| Yellow | Human tissues, organs, body parts and fetus below the viability period (as per the Medical Termination of Pregnancy Act 1971, amended from time to time). | Yellow coloured  non-chlorinated  plastic bags | Incineration or Plasma Pyrolysis or deep burial \* |
| **Animal Anatomical Waste** : Experimental animal carcasses, body parts, organs, tissues, including the waste generated from animals used in experiments or testing in veterinary hospitals or colleges or animal houses. |
| **Soiled Waste:** Items contaminated with blood, body fluids like dressings, plaster casts, cotton swabs and bags containing residual or discarded blood and blood components. |  | Incineration or Plasma Pyrolysis or deep burial \*                                                                  In absence of above facilities, autoclaving or micro-waving/ hydroclaving followed by shredding or mutilation or combination of sterilization and shredding. Treated waste to be sent for energy recovery. |
| **Expired or Discarded Medicines:** Pharmaceutical waste like antibiotics, cytotoxic drugs including all items contaminated with cytotoxic drugs along with glass or plastic ampoules, vials etc. | Yellow coloured  non-chlorinated  plastic bags or  containers | Expired cytotoxic drugs and items contaminated with cytotoxic drugs to be returned back to the manufacturer or supplier for incineration at temperature >1200 0 C or to common bio - medical waste treatment facility or hazardous waste treatment, storage and disposal facility for incineration at >1200 0 C Or Encapsulation or Plasma Pyrolysis at >1200 0 C All other discarded medicines shall be either sent back to manufacturer or disposed by incineration. |
| **Chemical Waste:** Chemicals used in production of biological and used or discarded disinfectants. | Yellow coloured  containers or  non-chlorinated  plastic bags | Disposed of by incineration or Plasma Pyrolysis or Encapsulation in hazardous waste treatment, storage and disposal facility . |
| **Chemical Liquid Waste :** Liquid waste generated due to use of chemicals in production of biological and used or discarded disinfectants, Silver X - ray film developing liquid, discarded Formalin, infected secretions, aspirated body fluids , liquid from laboratories an d floor washings, cleaning, house - keeping and disinfecting activities etc. | Separate  collection  system leading  to effluent  treatment system | After resource recovery, the chemical liquid waste shall be pre - treated before mixing with other wastewater. The combined discharge shall conform to the discharge norms given in Schedule - III. |
| Discarded linen, mattresses, beddings contaminated with blood or body fluid. | Non-chlorinated  yellow plastic  bags or suitable  packing material | Non - chlorinated chemical disinfection followed by incineration or Plazma Pyrolysis or for energy recovery. In absence of above facilities, shredding or mutilation or combination of sterilization and shredding. Treated waste to be sent for energy recovery or incineration or Plazma Pyrolysis . |
| **Microbiology, Biotechnology and other clinical laboratory waste:** Blood bags, Laboratory cultures, stocks or specimens of micro - organisms, live or attenuated vaccines, human and animal cell cultures used in research, industrial laboratories, production of biological, residual toxins, dishes and devices used for cultures. | Autoclave safe  plastic bags or  containers | Pre - treat to sterilize with non - chlorinated chemicals on - site as per National AIDS Control Organisation or World Health Organisation guidelines thereafter for Incineration. |
| Red | Contaminated Waste (Recyclable)                   Wastes generated from disposable items such as tubing, bottles, intravenous tubes and sets, catheters, urine bags, syringes (without needles and fixed needle syringes ) and vaccutainers with their needles cut) and gloves. | Red coloured  non-chlorinated  plastic bags or  containers | Autoclaving or micro - waving/ hydroclaving followed by shredding or mutilation or combination of sterilization and shredding. Treated waste to be sent to registered or authorized recyclers or for energy recovery or plastics to diesel or fuel oil or for road making, whichever is possible. Plastic waste should not be sent to landfill sites. |
| White (Translucent) | **Waste sharps including Metals**: Needles, syringes with fixed needles, needles from needle tip cutter or burner, scalpels, blades, or any other contaminated sharp object that may cause puncture and cuts. This includes both used, discarded and contaminated metal sharps | Puncture proof,  Leak proof,  tamper proof  containers | Autoclaving or Dry Heat Sterilization followed by shredding or mutilation or encapsulation in metal container or cement concrete; combination of shredding cum autoclaving; and sent for final disposal to iron foundries (having consent to operate from the State Pollution Control Board s or Pollution Control Committee s) or sanitary landfill or designated concrete waste sharp pit. |
| Blue | **Glassware:** Broken or discarded and contaminated glass including medicine vials and ampoules except those contaminated with cytotoxic wastes | Cardboard boxes  with blue  colored marking | Disinfection (by soaking the washed glass waste after cleaning with detergent and Sodium Hypochlorite treatment) or through autoclaving or microwaving or hydroclaving and then sent for recycling. |
| Metallic Body Implants |

\* Disposal by deep burial is permitted only in rural or remote areas where there is no access to common bio - medical waste treatment facility. This will be carried out with prior approval from the prescribed authority and as per the Standards specified in Schedule - III. The deep burial facility shall be located as per the provisions and guidelines issued by Central Pollution Control Board from time to time.

### Segregation

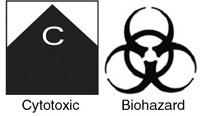
Segregation refers to the basic separation of different categories of waste generated at source and thereby reducing the risks as well as cost of handling and disposal. Segregation is the most crucial step in bio-medical waste management. Effective segregation alone can ensure effective bio-medical waste management.

#### How does segregation help?

* Segregation reduces the amount of waste needs special handling and treatment
* Effective segregation process prevents the mixture of medical waste like sharps with the general 

municipal waste.

* Prevents illegally reuse of certain components of medical waste like used syringes, needles and other plastics.
* Provides an opportunity for recycling certain components of medical waste like plastics after proper and thorough disinfection.
* Recycled plastic material can be used for non-food grade applications.
* Of the general waste, the biodegradable waste can be composted within the hospital premises and can be used for gardening purposes.
* Recycling is a good environmental practice, which can also double as a revenue generating activity.
* Reduces the cost of treatment and disposal (80 per cent of a hospital’s waste is general waste, which does not require special treatment, provided it is not contaminated with other infectious waste)

**Proper labelling of bins**  
The bins and bags should carry the biohazard symbol indicating the nature of waste to the patients and public.

#### Collectionhttp://vikaspedia.in/resolveuid/9d89d28b8077482cb23173a4581bb90c

The collection of biomedical waste involves use of different types of container from various sources of biomedical wastes like Operation Theatre, laboratory, wards, kitchen, corridor etc. The containers/ bins should be placed in such a way that 100 % collection is achieved. Sharps must always be kept in puncture-proof containers to avoid injuries and infection to the workers handling them.

#### STORAGE: once collection occurs then biomedical waste is stored in a proper place. Segregated wastes of different categories need to be collected in identifiable containers. The duration of storage should not exceed for 8-10 hrs in big hospitals (more than 250 bedded) and 24 hrs in nursing homes. Each container may be clearly labelled to show the ward or room where it is kept. The reason for this labelling is that it may be necessary to trace the waste back to its source. Besides this, storage area should be marked with a caution sign.

#### Transportation



The waste should be transported for treatment either in trolleys or in covered wheelbarrow. Manual loading should be avoided as far as for as possible. The bags / Container containing BMWs should be tied/ lidded before transportation. Before transporting the bag containing BMWs, it should be accompanied with a signed document by Nurse/ Doctor mentioning date, shift, quantity and destination.

Special vehicles must be used so as to prevent access to, and direct contact with, the waste by the transportation operators, the scavengers and the public. The transport containers should be properly enclosed. The effects of traffic accidents should be considered in the design, and the driver must be trained in the procedures he must follow in case of an accidental spillage. It should also be possible to wash the interior of the containers thoroughly.

#### Personnel safety devices

The use of protective gears should be made mandatory for all the personnel handling waste.

**Gloves:** Heavy-duty rubber gloves should be used for waste handling by the waste retrievers. This should be bright yellow in colour. After handling the waste, the gloves should be washed twice. The gloves should be washed after every use with carbolic soap and a disinfectant.  The size should fit the operator.

Aprons, gowns, suits or other apparels: Apparel is worn to prevent contamination of clothing and protect skin. It could be made of cloth or impermeable material such as plastic. People working in incinerator chambers should have gowns or suits made of non-inflammable material.

**Masks:** Various types of masks, goggles, and face shields are worn alone or in combination, to provide a protective barrier. It is mandatory for personnel working in the incinerator chamber to wear a mask covering both nose and mouth, preferably a gas mask with filters.

**Boots:** Leg coverings, boots or shoe-covers provide greater protection to the skin when splashes or large quantities of infected waste have to be handled. The boots should be rubber-soled and anti-skid type. They should cover the leg up to the ankle.

#### Cleaning devices

**Brooms:** The broom shall be a minimum of 1.2 m long, such that the worker need not stoop to sweep. The diameter of the broom should be convenient to handle. The brush of the broom shall be soft or hard depending on the type of flooring.

**Dustpans:** The dustpans should be used to collect the dust from the sweeping operations. They may be either of plastic or enamelled metal. They should be free of ribs and should have smooth contours, to prevent dust from sticking to the surface. They should be washed with disinfectants and dried before every use.

**Mops:** Mops with long handles must be used for swabbing the floor. They shall be of either the cloth or the rubber variety. The mop has to be replaced depending on the wear and tear. The mechanical-screw type of mop is convenient for squeezing out the water.

**Vacuum cleaners:** Domestic vacuum cleaners or industrial vacuum cleaners can be used depending on the size of the rooms.  


#### Storage devices

**Dustbins:**



It is very important to assess the quantity of waste generated at each point. Dustbins should be of such capacity that they do not overflow between each cycle of waste collection. Dustbins should be cleaned after every cycle of clearance of waste with disinfectants. Dustbins can be lined with plastic bags, which are chlorine-free, and colour coded as per the law.

#### Handling devices

**Trolleys**

The use of trolleys will facilitate the removal of infectious waste at the source itself, instead of adding a new category of waste.

**Wheelbarrows:**



Wheelbarrows are used to transfer the waste from the point source to the collection centres. There are two types of wheelbarrow – covered and open. Wheelbarrows are made of steel and provided with two wheels and a handle. Care should be taken not to directly dump waste into it. Only packed waste (in plastic bags) should be carried. Care should also be taken not to allow liquid waste from spilling into the wheelbarrow, as it will corrode. These are ideal for transferring debris within the institution. Wheelbarrows also come in various sizes depending on the utility.

**Chutes:**



Chutes are vertical conduits provided for easy transportation of refuse vertically in case of institutions with more than two floors. Chutes should be fabricated from stainless steel. It should have a self-closing lid. These chutes should be fumigated everyday with formaldehyde vapours. The contaminated linen (contaminated with blood and or other body fluids) from each floor should be bundled in soiled linen or in plastic bags before ejecting into the chute.

Alternately, elevators with mechanical winches or electrical winches can be provided to bring down waste containers from each floor. Chutes are necessary to avoid horizontal transport of waste thereby minimizing the routing of the waste within the premises and hence reducing the risk of secondary contamination.

1. **EXPLAIN HAZARDOUS WASTE MANAGEMENTAND HANDLING RULES**

Hazardous Waste Management Rules are notified to ensure safe handling , generation, processing, treatment, package, storgae, transportation, use reporcessing, collection, conversion, and  offering for sale, destruction and disposal of Hasardous Waste. These Rules came into effect in the year 1989 and have been amemded later in the years 2000, 2003 and with final notification  of the Hazardous Waste ( Management, Handling and Transboundary Movement) Rules, 2008 in supersession of former notification. The Rules lay down corresponding duties of various  authorities such as MoEF, CPCB, State/UT Govts., SPCBs/PCCs, DGFT, Port Authority and Custom Authority while State Pollution Control Boards/ Pollution Control Committees have  been designated with wider responsibilites touching across almost every aspect of Hazardous wastes generation, handing and their disposal.

### Draft Notifications For public comments including Draft Waste Management Rules,2015

* Draft notification on the various Standards
  1. [Fertilizer Industry](http://neerienvis.nic.in/pdf/rules_in_india/Fertilizer.pdf)
  2. [Paint Industry](http://neerienvis.nic.in/pdf/rules_in_india/Piant%20Industry.pdf)
  3. [Sugar Industry](http://neerienvis.nic.in/pdf/rules_in_india/Sugar%20Industry.pdf)
  4. [Pulp & Paper Industry](http://neerienvis.nic.in/pdf/rules_in_india/Pulp%20&%20Paper%20Industry.pdf)
  5. [Cement Plant with co-processing of wastes](http://neerienvis.nic.in/pdf/rules_in_india/Cement%20plant%20with%20co-processing%20of%20wastes.pdf)

### Notifications For public comments

* [Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 [http://neerienvis.nic.in/images/new-y.gif](http://neerienvis.nic.in/pdf/rules_in_india/(MOEFF)%20Final%20HWM%20Rules%202016%20(English).pdf)](http://neerienvis.nic.in/pdf/rules_in_india/%28MOEFF%29%20Final%20HWM%20Rules%202016%20%28English%29.pdf)
* [Hazardous Waste (Management, Handling & Transboundary Movement) Rules, 2008](http://cpcb.nic.in/divisionsofheadoffice/hwmd/mhtrules2008.pdf)

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| --- | --- |
| [Schedule I](http://cpcb.nic.in/divisionsofheadoffice/hwmd/Schedule%20%20I.pdf) | [Schedule V](http://cpcb.nic.in/divisionsofheadoffice/hwmd/Schedule%20%20V.pdf) |
| [Schedule II](http://cpcb.nic.in/divisionsofheadoffice/hwmd/Schedule%20%20II.pdf) | [Schedule VI](http://cpcb.nic.in/divisionsofheadoffice/hwmd/Schedule%20%20VI.pdf) |
| [Schedule III](http://cpcb.nic.in/divisionsofheadoffice/hwmd/Schedule%20III.pdf) | [Schedule VII](http://cpcb.nic.in/divisionsofheadoffice/hwmd/Schedule%20%20VII.pdf) |
| [Schedule IV](http://cpcb.nic.in/divisionsofheadoffice/hwmd/Schedule%20IV.pdf) | [Notification](http://cpcb.nic.in/divisionsofheadoffice/hwmd/mhtrules2008.pdf) |

* [Fourth Amendments Rules, 13th August, 2010](http://www.cpcb.nic.in/4th_Amendments_Rules.pdf)
* [Third Amendments Rules, 30th March, 2010](http://www.cpcb.nic.in/3rd_Amendment_Rules.pdf)
* [Second Amendments Rules, 23rd Sep, 2009](http://www.cpcb.nic.in/2nd_Amendments_Rules.pdf)
* [First Amendments Rules, 21st July, 2009](http://www.cpcb.nic.in/1st_Amendments_Rules.pdf)

### Hazardous Waste Rules

    ⇒[List of units granted permission under Rule 11 of HW (Management, Handling and Transboundary Movement) Rules, 2008, for utilization of hazardous waste](http://cpcb.nic.in/List_Units_Hazardous_Waste_06022014.PDF)

    ⇒[Minutes of the Ninth Meeting of the Technical Expert Committee for Evaluation of proposal for utilization of the hazardous wastes under Rule 11 of the Hazardous Waste (Management, Handling & Transboundary) Rules, 2008](http://cpcb.nic.in/Minutes_IX_Meeting_HWM.PDF)

    ⇒ [Minutes of the Eight Meeting of the Technical Expert Committee for Evaluation of proposal for utilization of the hazardous wastes under Rule 11 of the Hazardous Waste (Management, Handling & Transboundary) Rules, 2008](http://cpcb.nic.in/Minutes_VIII_Meeting_HWM.PDF)

    ⇒[Minutes of the Seventh Meeting of the Technical Expert Committee for Evaluation of proposal for utilization of the hazardous wastes under Rule 11 of the Hazardous Waste (Management, Handling & Transboundary) Rules, 2008](http://cpcb.nic.in/Minutes_VII_Meeting_HWM.PDF)

    ⇒ [Minutes of the Sixth Meeting of the Technical Expert Committee for Evaluation of proposal for utilization of the hazardous wastes under Rule 11 of the Hazardous Waste (Management, Handling & Transboundary) Rules, 2008](http://neerienvis.nic.in/cpcb.nic.in/HWMD_VI_MIN_TEC_MEET.PDF)

    ⇒[Minutes of the Fifth Meeting of the Technical Expert Committee for Evaluation of proposal for utilization of the hazardous wastes under Rule 11 of the Hazardous Waste (Management, Handling & Transboundary) Rules, 2008](http://cpcb.nic.in/HWMD_V_MIN_TEC_MEET.PDF)

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    ⇒[Minutes of the Fourth Meeting of the Technical Expert Committee for Evaluation of proposal for utilization of the hazardous wastes under Rule 11 of the Hazardous Waste (Management, Handling & Transboundary) Rules, 2008](http://neerienvis.nic.in/cpcb.nic.in/HWMD_IV_MIN_TEC_MEET.pdf)

    ⇒[Minutes of the Third Meeting of the Technical Expert Committee for Evaluation of proposal for utilization of the hazardous wastes under Rule 11 of the Hazardous Waste (Management, Handling & Transboundary) Rules, 2008](http://neerienvis.nic.in/cpcb.nic.in/hwmd_min_3rdmeeting_tec.pdf)

    ⇒[Minutes of the Second Meeting of the Technical Expert Committee for "Evaluation of proposal for utilization of the hazardous wastes as a supplementary resource or for energy recovery, or after processing"](http://cpcb.nic.in/wast/hazardouswast/MinutesSecondMeeting.PDF)

    ⇒[Minutes of the First Meeting of the Technical Expert Committee for "Evaluation of proposal for utilization of the hazardous wastes as a supplementary resource or for energy recovery, or after processing"](http://cpcb.nic.in/wast/hazardouswast/TECmeetingMinutes.pdf)

    ⇒[Hazardous Waste (Management, Handling and Transboundary Movement) Fourth Ammendments Rules, 2010](http://cpcb.nic.in/wast/hazardouswast/Haz.WasteRule-2010.PDF)

    ⇒[Hazardous Waste (Management, Handling ) Rules, 2003 ( Old Rules for reference only)](http://cpcb.nic.in/wast/hazardouswast/HWRules-2003.pdf)

1. **EXPLAIN EIA**

**Introduction** Environmental Impact Assessment (EIA) is an important management tool for ensuring optimal use of natural resources for sustainable development. A beginning in this direction was made in our country with the impact assessment of river valley projects in 1978-79 and the scope has subsequently been enhanced to cover other developmental sectors such as industries, thermal power projects, mining schemes etc. To facilitate collection of environmental data and preparation of management plans, guidelines have been evolved and circulated to the concerned Central and State Government Departments. EIA has now been made mandatory under the Environmental (Protection Act, 1986 for 29 categories of developmental activities involving investments of Rs. 50 crores and above.  
  
**Environmental Appraisal Committees** With a view to ensure multi-disciplinary input required for environmental appraisal of development projects, Expert Committees have been constituted for the following sectors:

1. Mining Projects
2. Industrial Projects
3. Thermal Power Projects
4. River Valley, Multipurpose, Irrigation and H.E. Projects
5. Infrastructure Development and Miscellaneous Projects
6. Nuclear Power Projects

**Environmental Appraisal Procedure**

Once an application has been submitted by a project authority alongwith all the requisite documents specified in the EIA Notification, it is scrutinised by the technical staff of the Ministry prior to placing it before the Environmental Appraisal Committees. The Appraisal Committees evaluate the impact of the project based on the data furnished by the project authorities and if necessary, site visits or on-the-spot assessment of various environmental aspects are also undertaken. Based on such examination, the Committees make recommendations for approval or rejection of the project, which are then processed in the Ministry for approval or rejection.  
In case of site specific projects such as Mining, River Valley, Ports and Harbours etc., a two stage clearance procedure has been adopted whereby the project authorities have to obtain site clearance before applying for environmental clearance of their projects. This is to ensure avoiding areas which are ecologically fragile and environmentally sensitive. In case of projects where complete information has been submitted by the project proponents, a decision is taken within 90 days.  
  
**Monitoring**

After considering all the facets of a project, environmental clearance is accorded subject to implementation of the stipulated environmental safeguards. Monitoring of cleared projects is undertaken by the six regional offices of the Ministry functioning at Shillong, Bhubaneshwar, Chandigarh, Bangalore, Lucknow and Bhopal. The primary objective of such a procedure is to ensure adequacy of the suggested safeguards and also to undertake mid-course corrections required, if any. The procedure adopted for monitoring is as follows:

1. Project authorities are required to report every six months on the progress of implementation of the conditions/safeguards stipulated, while according clearance to the project.
2. Field visits of officers and expert teams from the Ministry and/ or its Regional Offices are undertaken to collect and analyse performance data of development projects, so that difficulties encountered are discussed with the proponents with a view to finding solutions.
3. In case of substantial deviations and poor or no response, the matter is taken up with the concerned State Government.
4. Changes in scope of project are identified to check whether review of earlier decision is called for or not.

**Coastal Area Management**

Coastal States/UTs are required to prepare Coastal Zone Management Plans (CZMPs) as per the provisions of the Coastal Regulation Zone (CRZ) Notification 1991, identifying and categorising the coastal areas for different activities and submit it to the Ministry for approval.  
The Ministry has constituted a Task Force for examination of these plans submitted by Maharashtra and Gujarat States have been discussed in the meetings of the Task Force and these need to be modified. The Government of Orissa has submitted a partial plan covering only a part of their coastal area. In respect of West Bengal, a preliminary concept document of the CZMP has been submitted. Revised CZMP/clarifications have been received from the State of Goa and UTs of Daman & Diu, Lakshadweep and Andaman & Nicobar Islands.  
During the year, the Task Force had seven meetings and two site visits for consideration of the plans. Once the plans of the different States/UTs are finalised, the development activities in the coastal belt would be more forcefully regulated to ensure non-violation of CRZ Notification.  
  
**Island Development Authority (IDA)**

The 9th meeting of IDA was held on 22.1.96 under the Chairmanship of the Prime Minister to decide on various policies and programmes aimed at integrated development of the islands, keeping in view the relevent aspects of environmental protection, and also to review the progress of implementation and impact of the programmes of development.

1. **EXPLAIN TOWARDS SUSTAINABLE DEVELOPMENT**

**Sustainable development** is defined as a process of meeting [human development](https://en.wikipedia.org/wiki/Human_development_%28humanity%29) goals while [sustaining](https://en.wikipedia.org/wiki/Sustainability) the ability of natural systems to continue to provide the [natural resources](https://en.wikipedia.org/wiki/Natural_resources) and [ecosystem services](https://en.wikipedia.org/wiki/Ecosystem_services) upon which the [economy](https://en.wikipedia.org/wiki/Economy) and [society](https://en.wikipedia.org/wiki/Society) depends. While the modern concept of sustainable development is derived most strongly from the 1987 [Brundtland Report](https://en.wikipedia.org/wiki/Brundtland_Commission), it is rooted in earlier ideas about [sustainable forest management](https://en.wikipedia.org/wiki/Sustainable_forest_management) and twentieth century environmental concern

Environmental sustainability concerns the [natural environment](https://en.wikipedia.org/wiki/Natural_environment) and how it endures and remains diverse and productive. Since [natural resources](https://en.wikipedia.org/wiki/Natural_resources) are derived from the environment, the state of air, water, and the climate are of particular concern. The [IPCC Fifth Assessment Report](https://en.wikipedia.org/wiki/IPCC_Fifth_Assessment_Report) outlines current knowledge about scientific, technical and socio-economic information concerning [climate change](https://en.wikipedia.org/wiki/Climate_change), and lists options for [adaptation](https://en.wikipedia.org/wiki/Adaptation_to_global_warming) and [mitigation](https://en.wikipedia.org/wiki/Climate_change_mitigation).[[22]](https://en.wikipedia.org/wiki/Sustainable_development#cite_note-Climate_Change_2014:_Impacts.2C_Adaptation_and_Vulnerability-22) Environmental sustainability requires society to design activities to meet human needs while preserving the life support systems of the planet. This, for example, entails using water sustainably, utilizing renewable energy, and sustainable material supplies (e.g. harvesting wood from forests at a rate that maintains the biomass and biodiversity

This topic is central to the understanding of creating a sustainable situation from the management of the public resources that are used for personal use.

#### Agriculture

Sustainable agriculture consists of [environment friendly](https://en.wikipedia.org/wiki/Environment_friendly) methods of farming that allow the production of crops or livestock without damage to human or natural systems. It involves preventing adverse effects to soil, water, biodiversity, surrounding or downstream resources—as well as to those working or living on the farm or in neighboring areas. The concept of sustainable agriculture extends intergenerationally, passing on a conserved or improved natural resource, biotic, and economic base rather than one which has been depleted or polluted.[[27]](https://en.wikipedia.org/wiki/Sustainable_development#cite_note-27) Elements of sustainable agriculture include [permaculture](https://en.wikipedia.org/wiki/Permaculture), [agroforestry](https://en.wikipedia.org/wiki/Agroforestry), [mixed farming](https://en.wikipedia.org/wiki/Mixed_farming), [multiple cropping](https://en.wikipedia.org/wiki/Multiple_cropping), and [crop rotation](https://en.wikipedia.org/wiki/Crop_rotation).[[28]](https://en.wikipedia.org/wiki/Sustainable_development#cite_note-28)

Numerous [sustainability standards and certification](https://en.wikipedia.org/wiki/Sustainability_standards_and_certification) systems exist, including [organic certification](https://en.wikipedia.org/wiki/Organic_certification), [Rainforest Alliance](https://en.wikipedia.org/wiki/Rainforest_Alliance), [Fair Trade](https://en.wikipedia.org/wiki/Fairtrade_certification), [UTZ Certified](https://en.wikipedia.org/wiki/UTZ_Certified), Bird Friendly, and the Common Code for the Coffee Community (4C).[[29]](https://en.wikipedia.org/wiki/Sustainable_development#cite_note-29)[[30]](https://en.wikipedia.org/wiki/Sustainable_development#cite_note-30)

### Economics

[](https://en.wikipedia.org/wiki/File:Depuradora_de_Lluc.JPG)

A [sewage treatment](https://en.wikipedia.org/wiki/Sewage_treatment) plant that uses [solar energy](https://en.wikipedia.org/wiki/Solar_energy), located at [Santuari de Lluc](https://en.wikipedia.org/wiki/Santuari_de_Lluc) monastery, Majorca.

It has been suggested that because of rural [poverty](https://en.wikipedia.org/wiki/Poverty) and [overexploitation](https://en.wikipedia.org/wiki/Overexploitation), environmental resources should be treated as important economic assets, called [natural capital](https://en.wikipedia.org/wiki/Natural_capital).[[31]](https://en.wikipedia.org/wiki/Sustainable_development#cite_note-31) Economic development has traditionally required a growth in the [gross domestic product](https://en.wikipedia.org/wiki/Gross_domestic_product). This model of unlimited personal and GDP growth may be over.[[32]](https://en.wikipedia.org/wiki/Sustainable_development#cite_note-32) Sustainable development may involve improvements in the quality of life for many but may necessitate a decrease in resource consumption.[[33]](https://en.wikipedia.org/wiki/Sustainable_development#cite_note-33) According to ecological economist [Malte Faber](https://de.wikipedia.org/wiki/Malte_Michael_Faber), ecological economics is defined by its focus on nature, justice, and time. Issues of [intergenerational equity](https://en.wikipedia.org/wiki/Intergenerational_equity), [irreversibility](https://en.wikipedia.org/wiki/Irreversibility) of environmental change, [uncertainty](https://en.wikipedia.org/wiki/Uncertainty) of long-term outcomes, and sustainable development guide ecological economic analysis and valuation.

#### Environmental economics

The total environment includes not just the biosphere of earth, air, and water, but also human interactions with these things, with nature, and what humans have created as their surroundings.[[53]](https://en.wikipedia.org/wiki/Sustainable_development#cite_note-53)

As countries around the world continue to advance economically, they put a strain on the ability of the natural environment to absorb the high level of pollutants that are created as a part of this economic growth. Therefore, solutions need to be found so that the economies of the world can continue to grow, but not at the expense of the public good. In the world of economics the amount of environmental quality must be considered as limited in supply and therefore is treated as a scarce resource. This is a resource to be protected. One common way to analyze possible outcomes of policy decisions on the scarce resource is to do a cost-benefit analysis. This type of analysis contrasts different options of resource allocation and, based on an evaluation of the expected courses of action and the consequences of these actions, the optimal way to do so in the light of different policy goals can be elicited.[[54]](https://en.wikipedia.org/wiki/Sustainable_development#cite_note-54)

Benefit-cost analysis basically can look at several ways of solving a problem and then assigning the best route for a solution, based on the set of consequences that would result from the further development of the individual courses of action, and then choosing the course of action that results in the least amount of damage to the expected outcome for the environmental quality that remains after that development or process takes place. Further complicating this analysis are the interrelationships of the various parts of the environment that might be impacted by the chosen course of action. Sometimes it is almost impossible to predict the various outcomes of a course of action, due to the unexpected consequences and the amount of unknowns that are not accounted for in the benefit-cost analysis

#### Energy

Main articles: [Smart grid](https://en.wikipedia.org/wiki/Smart_grid) and [Sustainable energy](https://en.wikipedia.org/wiki/Sustainable_energy)

Sustainable energy is clean and can be used over a long period of time. Unlike fossil fuels and biofuels that provide the bulk of the worlds energy, [renewable energy](https://en.wikipedia.org/wiki/Renewable_energy) sources like hydroelectric, solar and wind energy produce far less pollution. [Solar energy](https://en.wikipedia.org/wiki/Solar_energy) is commonly used on public parking meters, street lights and the roof of buildings. [Wind power](https://en.wikipedia.org/wiki/Wind_power) has expanded quickly, its share of worldwide electricity usage at the end of 2014 was 3.1%.[[58]](https://en.wikipedia.org/wiki/Sustainable_development#cite_note-58) Most of California's fossil fuel infrastructures are sited in or near low-income communities, and have traditionally suffered the most from California's fossil fuel energy system. These communities are historically left out during the decision-making process, and often end up with dirty power plants and other dirty energy projects that poison the air and harm the area. These toxicants are major contributors to health problems in the communities. As renewable energy becomes more common, fossil fuel infrastructures are replaced by renewables, providing better social equity to these communities.[[](https://en.wikipedia.org/wiki/Sustainable_development#cite_note-59) Overall, and in the long run, sustainable development in the field of energy is also deemed to contribute to economic sustainability and national security of communities, thus being increasingly encouraged through investment policies.

#### Manufacturing

Main articles: [Green manufacturing](https://en.wikipedia.org/w/index.php?title=Green_manufacturing&action=edit&redlink=1) and [Distributed manufacturing](https://en.wikipedia.org/wiki/Distributed_manufacturing)

#### Technology

One of the core concepts in sustainable development is that technology can be used to assist people meet their developmental needs. Technology to meet these sustainable development needs is often referred to as [appropriate technology](https://en.wikipedia.org/wiki/Appropriate_technology), which is an ideological movement (and its manifestations) originally articulated as [intermediate technology](https://en.wikipedia.org/wiki/Intermediate_technology) by the economist [E. F. Schumacher](https://en.wikipedia.org/wiki/E._F._Schumacher) in his influential work, [*Small is Beautiful*](https://en.wikipedia.org/wiki/Small_is_Beautiful)*.* and now covers a wide range of technologies. Both Schumacher and many modern-day proponents of appropriate technology also emphasise the technology as people-centered. Today appropriate technology is often developed using [open source](https://en.wikipedia.org/wiki/Open_source) principles, which have led to [open-source appropriate technology](https://en.wikipedia.org/wiki/Open-source_appropriate_technology) (OSAT) and thus many of the plans of the technology can be freely found on the [Internet](https://en.wikipedia.org/wiki/Internet). OSAT has been proposed as a new model of enabling [innovation](https://en.wikipedia.org/wiki/Innovation) for sustainable development.

#### Transport

Transportation is a large contributor to greenhouse gas emissions. It is said that one-third of all gasses produced are due to transportation. Motorized transport also releases exhaust fumes that contain particulate matter which is hazardous to human health and a contributor to climate change

Sustainable transport has many social and economic benefits that can accelerate local sustainable development. According to a series of reports by the [Low Emission Development Strategies Global Partnership (LEDS GP)](https://en.wikipedia.org/wiki/Low_Emission_Development_Strategies_Global_Partnership_%28LEDS_GP%29), sustainable transport can help create jobs, improve commuter safety through investment in bicycle lanes and pedestrian pathways make access to employment and social opportunities more affordable and efficient. It also offers a practical opportunity to save people's time and household income as well as government budgets,[[70]](https://en.wikipedia.org/wiki/Sustainable_development" \l "cite_note-70) making investment in sustainable transport a 'win-win' opportunity.

Some western countries are making transportation more sustainable in both long-term and short-term implementations. An example is the modifications in available transportation in [Freiburg, Germany](https://en.wikipedia.org/wiki/Freiburg_im_Breisgau). The city has implemented extensive methods of public transportation, cycling, and walking, along with large areas where cars are not allowed

#### Business

The most broadly accepted criterion for corporate sustainability constitutes a firm's efficient use of natural capital. This [eco-efficiency](https://en.wikipedia.org/wiki/Eco-efficiency) is usually calculated as the economic value added by a firm in relation to its aggregated ecological impact.[[74]](https://en.wikipedia.org/wiki/Sustainable_development#cite_note-74) This idea has been popularised by the World Business Council for Sustainable Development ([WBCSD](https://en.wikipedia.org/wiki/WBCSD)) under the following definition: "Eco-efficiency is achieved by the delivery of competitively priced goods and services that satisfy human needs and bring quality of life, while progressively reducing ecological impacts and [resource intensity](https://en.wikipedia.org/wiki/Resource_intensity) throughout the life-cycle to a level at least in line with the earth's carrying capacity

#### Income

At the present time, sustainable development, along with the solidarity called for in [Catholic social teaching](https://en.wikipedia.org/wiki/Catholic_social_teaching), can reduce [poverty](https://en.wikipedia.org/wiki/Poverty). While over many thousands of years the ‘stronger’ (economically or physically) overcame the weaker, nowadays for various reasons - Catholic social teaching, [social solidarity](https://en.wikipedia.org/wiki/Social_solidarity), sustainable development – the stronger helps the weaker. This aid may take various forms. ‘The Stronger’ offers real help rather than striving for the elimination or annihilation of the other. Sustainable development reduces [poverty](https://en.wikipedia.org/wiki/Poverty) through financial (among other things, a balanced budget), environmental (living conditions), and social (including equality of income) means.[[77]](https://en.wikipedia.org/wiki/Sustainable_development#cite_note-77)

#### Architecture In sustainable architecture the recent movements of [New Urbanism](https://en.wikipedia.org/wiki/New_Urbanism) and [New Classical architecture](https://en.wikipedia.org/wiki/New_Classical_architecture) promote a sustainable approach towards construction, that appreciates and develops [smart growth](https://en.wikipedia.org/wiki/Smart_growth), [architectural tradition](https://en.wikipedia.org/wiki/Vernacular_architecture) and [classical design](https://en.wikipedia.org/wiki/Classical_architecture).[[78]](https://en.wikipedia.org/wiki/Sustainable_development#cite_note-78)[[79]](https://en.wikipedia.org/wiki/Sustainable_development#cite_note-79) This in contrast to [modernist](https://en.wikipedia.org/wiki/Modern_architecture) and [International Style](https://en.wikipedia.org/wiki/International_Style_%28architecture%29) architecture, as well as opposing to solitary [housing estates](https://en.wikipedia.org/wiki/Housing_estate) and [suburban sprawl](https://en.wikipedia.org/wiki/Urban_sprawl), with long commuting distances and large ecological footprints.[[80]](https://en.wikipedia.org/wiki/Sustainable_development#cite_note-80) Both trends started in the 1980s. (It should be noted that sustainable architecture is predominantly relevant to the economics domain while architectural landscaping pertains more to the ecological domain.)

### Politics:A study concluded that social indicators and, therefore, sustainable development indicators, are scientific constructs whose principal objective is to inform public policy-making.[[81]](https://en.wikipedia.org/wiki/Sustainable_development#cite_note-81) The [International Institute for Sustainable Development](https://en.wikipedia.org/wiki/International_Institute_for_Sustainable_Development) has similarly developed a political policy framework, linked to a sustainability index for establishing measurable entities and metrics. The framework consists of six core areas, international trade and investment, economic policy, climate change and energy, measurement and assessment, natural resource management, and the role of communication technologies in sustainable development.

### EXPLAIN POPULATION AND ITS EXPLOSION

### Population is defined as the total number of individuals of a species present in a particular area at a given time. A species has many populations living in different regions.

### the rapid increase in population over a relatively short period is called population explosion. The world population which was around 2 billion (2000 million) in 1900 reached about 6 billion by 2000. A similar trend was observed in India too. Our population which was approximately 350 million at the time of our independence reached close to the billion mark by 2000 and crossed 1 billion in May 2000.

**Reasons for High Population Growth:**

There are two main factors for the increase in human population. (A) Decrease in death rate mainly maternal mortality rate (MMR) and infant mortality rate (IMR) and (B) Increase in span of life. Reasons for growth of human population are briefly described here.

**(i) Spread of Education:**

Persons of the country are being educated about the diseases.

**(ii) Control of Diseases:**

Control of various communicable diseases is in practice.

**(iii) Advancement in Agriculture:**

Farmers are educated to develop high yielding crops.

**(iv) Storage Facilities:**

A good quantity of grains can be stored easily.

**(v) Better Transport:**

This protects from famines.

**(vi) Protection from Natural Calamity:**

It decreases death rate.

**(vii) Government Efforts:**

Government is doing efforts to provide maximum information’s to the farmers.

**Malthus Theory of Human Population Growth:**

In 1798 T.R. Malthus, a British economist, put forward a theory of human population growth, (i) He stated that population grows geometrically (1, 2, 4, 8, 16, 32….) when unchecked, whereas the means of its subsistence like food grow only arithmetically (1, 2, 3, 4, 5, 6, 7….). (ii) Naturally, after some time an imbalance would occur in the population and the environment, (iii) When the imbalance reaches a certain value, some factors like hunger, epidemics, floods, earthquakes, war, etc. will bring the population to a desired level.

Such a population “crash” is called catastrophic control of population. These factors were called “positive checks” by Malthus.

**Consequences of Overpopulation:**

Over population leads to number of not only national but also individuals family prob­lems. Some of them are described below.

**1. Poverty:**

If in a family there are more persons and the income is less, so naturally it becomes poor. With the addition of every child, the poverty increases.

**2. Food supply:**

If the population increases and the production of food do not in­crease, this will lead to a shortage of food supply.

**3. Hygienic condition:**

More people in a small area generally make the hygienic condi­tions bad. There will be an accumulation of waste material as it is not removed that early.

**4. Unemployment:**

More number of people means more jobs and if sufficient number of jobs is not available, it leads to unemployment.

**5. Housing problem:**

For more people, more houses are required and the houses are not built at high rate.

**6. Pollution:**

There will be an added problem of population. As everything is taken from environment in excess, so it will result in pollution.

**7. Education problem:**

It becomes difficult for the government to provide education to all.

**REMEDIAL MEASURES**

#### A. Social Measure:

Population explosion is a social problem and it is deeply rooted in the society. So efforts must be done to remove the social evils in the country.

**1. Minimum age of Marriage:**

As fertility depends on the age of marriage. So the minimum age of marriage should be raised. In India minimum age for marriage is 21 years for men and 18 years for women has be fixed by law. This law should be firmly implemented and people should also be made aware of this through publicity.

**2. Raising the Status of Women:**

There is still discrimination to the women. They are confined to four walls of house. They are still confined to rearing and bearing of children. So women should be given opportunities to develop socially and economically. Free education should be given to them.

**3. Spread of Education:**

The spread of education changes the outlook of people. The educated men prefer to delay marriage and adopt small family norms. Educated women are health conscious and avoid frequent pregnancies and thus help in lowering birth rate.

**4. Adoption:**

Some parents do not have any child, despite costly medical treatment. It is advisable that they should adopt orphan children. It will be beneficial to orphan children and children couples.

**5. Change in Social Outlook:**

Social outlook of the people should undergo a change. Marriage should no longer be considered a social binding. Issueless women should not be looked down upon.

**6. Social Security:**

More and more people should be covered under-social security schemes. So that they do not depend upon others in the event of old age, sickness, unemployment etc. with these facilities they will have no desire for more children.

#### B. Economic Measures:

**The following are the economic measures:**

**1. More employment opportunities:**

The first and foremost measure is to raise, the employment avenues in rural as well as urban areas. Generally in rural areas there is disguised unemployment. So efforts should be made to migrate unemployed persons from rural side to urban side. This step can check the population growth.

**2. Development of Agriculture and Industry:**

If agriculture and industry are properly developed, large number of people will get employment. When their income is increased they would improve their standard of living and adopt small family norms.

**3. Standard of Living:**

Improved standard of living acts as a deterrent to large family norm. In order to maintain their higher standard of living people prefer to have a small family. According to A.K. Das Gupta those who earn less than Rs. 100 per month have on the average a reproduction rate of 3.4 children and those who earn more than Rs. 300 per month have a reproduction rate of 2.8 children.

**4. Urbanisation:**

It is on record that people in urban areas have low birth rate than those living in rural areas. Urbanisation should therefore be encouraged.

1. **EXPLAIN CONCEPT OF GREEN BUILDING**

*The U.S. EPA says “*Green building is the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building’s life-cycle from siting to design, construction, operation, maintenance, renovation and deconstruction. This practice expands and complements the classical building design concerns of economy, utility, durability, and comfort. Green building is also known as a sustainable or high performance building.*”*

Green buildings are designed in such a way to reduce overall impact on environment and human health by:

1. Reducing trash, pollution and degradation of environment.
2. Efficiently using energy, water and other resources.
3. Protecting occupant health and improving productivity.

**Benefits of Green Building**

**Environmental Benefits:**

* Reduce wastage of [water](http://www.conserve-energy-future.com/various-ways-to-conserve-water.php)
* Conserve natural resources
* Improve air and water quality
* Protect [biodiversity](http://www.conserve-energy-future.com/what-is-biodiversity.php) and ecosystems

**Economic Benefits:**

* Reduce operating costs
* Improve occupant productivity
* Create market for green product and services

**Social Benefits:**

* Improve quality of life
* Minimize strain on local infrastructure
* Improve occupant health and comfort

**The Goals of Green Building**

one of the main goals is to make the earth more sustainable, but it really does go deeper than that. When you decide to go green, your goal will be to actually help to sustain the environment without disrupting the natural habitats around it. When you start a building project, and you disrupt the natural habitats around it, you can actually make an impact in the wildlife and environment that will be much like a butterfly effect. Even the smallest changes that you can make will help to promote a better planet earth, and a better place for us all to live- not just us humans, but also the plants and wildlife that take up their residence here on earth as well.

