UNIT - V

# 13 CHAPTER

# Environmental Issues

Environment is my prime teacher

*- Masanabu Fukuoka*

## Chapter Outline



## Learning Objectives

- *Gain knowledge about our environment and its importance.*
- *Get to know about the effects and after effects of human activities on climate and ecosystem.*
- *Realize the need and importance of forests.*
- *Know about eco-friendly practices for pollution mitigation.*
- *Acquire insights into solutions to environmental problems.*
- *Understand the need for peoples' participation in environmental protection.*
- *Know about the global level conventions on climate change.*
- *Understand the importance of clean environment.*

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A clean environment is very necessary to live a peaceful and healthy life. But our environment is getting dirty day by day because of our negligence. Earth is currently facing a lot of environmental concerns like air pollution, water pollution, and noise pollution, global warming, acid rain, biomagnification, eutrophication, deforestation, waste disposal, ozone layer depletion and climate change. Over the last few decades, the exploitation of our planet and degradation of our environment have gone up at an alarming rate. As our actions have not been in favour of protecting this planet, we have seen natural disasters striking us more often in the form of flash floods, tsunami and cyclones.

"Every individual should be environmentally aware, regardless of whether they work with environmental issues or not."

## 13.1 Pollution

Pollution is any undesirable change in the physical, chemical and biological characteristics of the environment due to natural causes and human activities. The agents which cause pollution are called pollutants. Pollution is

classified according to the types of environment that is affected. They are mainly air, water and soil pollution.

### 13.1.1 Classification of Pollutants

**In terms of eco-system, pollutants can be classified into two basic groups – Non-degradable and degradable.** Based on the time taken to breakdown into their ingredients, degradable pollutants are classified as rapidly degradable (non-persistent) and slowly degradable (persistent).

**a) Rapidly degradable or non-persistent pollutants:** These can be broken down by natural processes. Domestic sewage and vegetable waste are examples of such pollutants.

**b) Slowly degradable or persistent pollutants:** These are pollutants that remain in the environment for many years in an unchanged condition and take decades or longer to degrade, as in the case of DDT.

**c) Non-degradable pollutants**: These cannot be degraded by natural processes. Once they are released into the environment, they are difficult to be eliminated and continue to accumulate (biomagnification). Toxic elements like lead, mercury, cadmium, chromium and nickel are such common pollutants.

## 13.2 Air Pollution

Earth is surrounded by a gaseous envelope which is called atmosphere. The gaseous blanket of the atmosphere acts as a thermal insulator and regulates the temperature of the earth by selectively absorbing The UV rays of solar radiation. The adverse effects of pollution include depletion of Ozone by Chlorofluorocarbons or CFCs, used as refrigerants and global warming by elevated $CO_2$ (industries, deforestation, and partial combustion).

The alterations or changes in the composition of the earth's atmosphere by natural or human activities (anthropogenic factors) are referred as **Air Pollution**. Pollutants include the abundant presence of solid, liquid or gaseous substances produced by human or natural activity. The nature and concentration of a pollutant determines the severity of detrimental effects

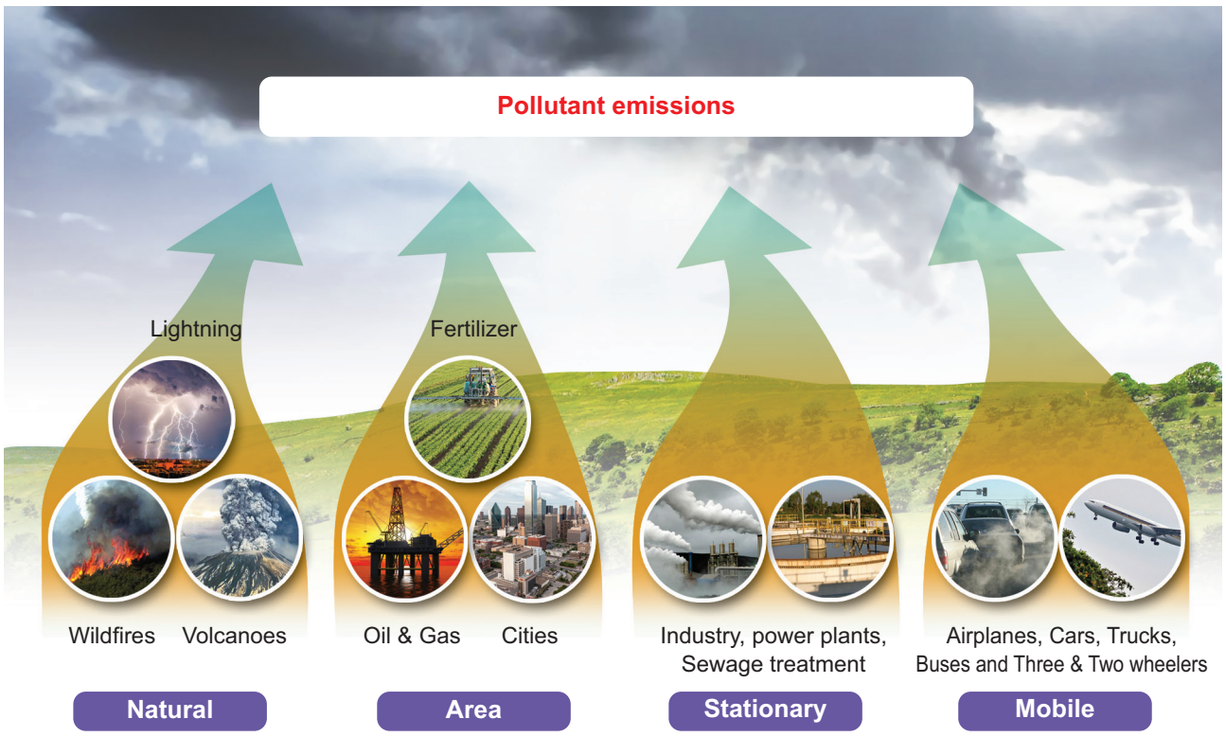


**Fig. 13.1 Sources of air pollution.**

on organisms and human health. Along with atmospheric factors (humidity, precipitation, wind, air currents, altitude) prevailing at a place and time, its effects can be far reaching and catastrophic.

Air pollutants can be

- discharge of dusts or particulate matter (PM: 2.5 ,10)
- discharge of gases ($SO_2$, $NO_2$, CO, $CO_2$)

Carbon monoxide (CO) is produced mainly due to incomplete combustion of fossil fuels. Automobiles are major causes of CO pollution in large cities and towns Automobile exhausts, fumes from factories, emission from power plants, forest fires and burning of fire-wood contribute to CO pollution.

With rapid urbanization, major amount of carbon dioxide and sulphur dioxide ($SO_2$) is released in the atmosphere. From automobiles, aeroplanes, power plants and other human activities that involving the burning of fossil fuels (coal, oil etc.,) $CO_2$ is the main pollutant that is leading to **global warming**.

**Nitrogen oxides** are also major air pollutants. Fossil fuel combustion and automobiles exhausts are the source of nitrogen oxides. Sulphur dioxide and nitrogen oxides are the major causes of acid rain.

Particulate matters are tiny particles of solid matter suspended in a gas or liquid. Combustion of fossil fuels, fly ash produced in thermal power plants, forest fires, asbestos mining units, cement factories are the main sources of particulate matter pollution.

### 13.2.1 Sources

The main sources of air pollution are:

- **Transport sources (Fig13.1)** – cars, buses, airplanes, trucks, trains
- **Stationary sources** – power plants, incinerators, oil refineries, industrial facilities, and factories
- **Area sources** – agricultural - wood / stubble burning, fireplaces
- **Natural sources** – wind-blown dust, wildfires, volcanoes (Fig. 13.1).

### 13.2.2 Effects of Air Pollution

- Affects all organisms as they depend on the atmosphere for respiration.
- Causes irritation in the throat, nose, lungs and eyes. It causes breathing problems and aggravates existing health conditions such as emphysema and asthma.
- Contaminated air reduces the body's defense mechanism and decreases the body's capacity to fight other infections in the respiratory system.
- Frequent exposure to polluted air increases the risk of cardiovascular diseases. Breathing air that is filled with fine particulate matter can induce hardening of the arteries, triggering cardiac arrhythmia or even a heart attack.
- People who exercise outdoors can sometimes be susceptible to adverse effects of air pollution because it involves deeper and faster breathing. Hence it is advisable to walk or jog in the mornings in places with ample tree cover.
- Gas leaks can be lethal or affect the quality of air in the affected area.
- CO in the atmosphere interferes with $O_2$ transport since haemoglopin has greater affinity for carbon monoxide. At low concentration it causes headache and blurred vision. In higher concentration, it can lead to coma and death.


**Sameer**, an App provides hourly updates on the National Air Quality Index (AQI) published by CPCB.

### 13.2.3 Other notable effects of Air Pollution

**Smog** is a type of air pollution caused by tiny particles in the air. The word comes from a mixture of the words smoke and fog .

Today, smog generally refers to photochemical smog, which is created when sunlight reacts with nitrogen oxides and volatile organic compounds found in fossil fuel emissions from automobiles, factories, and power plants. These reactions create ground-level ozone and particulate matter, reducing visibility. Smog can make breathing more difficult, especially for people with asthma.

Smog also affects plants and animals. It damages crops as well as causes health problems in pets, farm animals and human beings. Smog has also been known to cause corrosive damage to buildings and vehicles.

**Peroxyacetyl nitrate** (PAN) is a secondary pollutant present in photochemical smog. It is thermally unstable and decomposes into peroxyethanol radicals and nitrogen dioxide gas causing eye irritation.

**Global warming**: Increase in the concentrations of greenhouse gases such as $CO_2$, methane, nitrous oxide, CFCs, and ozone causes greenhouse effect, warming of the earth, resulting in sea level rise, submerging of islands and sea shores of various parts of the world.

**Ozone depletion**: Thinning of the stratospheric ozone layer is known as ozone depletion. Such depletion causes the 'ozone hole', resulting in poor screening of the harmful UV rays and increase in incidences of skin cancer. Some of the common agents that deplete ozone are CFCs.

**Acid rain**: Acid rain is a form of precipitation that contains acidic components, such as sulfuric acid or nitric acid. It damages trees, crops and harms marine animals (coral reefs) and induces corrosion.

### 13.2.4 Control of Air Pollution

Certain measures help to remove pollutants, reduce their presence or prevent their entry into the atmosphere.

- Trees are the best remedy for urban particulate and gaseous pollution
- Forests act as carbon sinks and lungs of the planet
- Catalytic converters in vehicles help to reduce polluting gases drastically
- Diesel exhaust filters in automobiles cuts particulates
- Electrostatic precipitators reduce release of industrial pollutants.
- Cost effective air pollution treatment systems like indoor plants and high performance biofilters can improve indoor air quality.

The Taj Mahal, a UNESCO world heritage site, is facing deterioration and damage by industrial gases due to several industrial units around Agra. The white marble has decolorized to yellow.

### 13.2.5 Legal Protection

- The **Air** (Prevention and Control of Pollution) **Act** was enacted in 1981 and amended in 1987 for the prevention, control and abatement of Air pollution in India.
- Traffic Emissions Standards: The Government has decided to enforce Bharat Stage VI norms from 2020.
- The Green Bench and the National Green Tribunal (NGT) give judicial safeguard to environmental protection.

Steps taken by the Central and the State governments in India:

- Road traffic rationing, encourage public transport, carpooling.

- Increase green cover alongside roads (planting avenue trees).
- Promoting Swachh Bharat Abhiyan
- Enactment and Enforcement of stricter environmental laws
- Maintenance of air standards by proper enforcement and monitoring


Average human consumption of Oxygen per day = 550 L

Cost of 2.75 L Oxygen cylinder = ₹ 6500

Cost of 550 L of oxygen from tree = ₹ 13,00,000

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Oxygen production by one healthy tree per year =1,00,375 L

Cost of 2.75 L oxygen cylinder = ₹ 6500

Cost of 1,00,375 L of oxygen from one tree /year = ₹ 23,72,50,000

- Reducing carbon emissions
- Encourage use of renewable energy
- Limiting the sale of firecrackers and developing eco-friendly crackers
- Make Environmental Impact Assessment mandatory

**Air Quality Index** (AQI) is a number used by government agencies to communicate to the public how polluted the air is at a given time.

| Air Quality Index | | |
|---|---|---|
| **AQI** | **Air Pollution Level** | **Colour** |
| 0-50 | Good | |
| 51-100 | Moderate | |
| 101-150 | Unhealthy for Sensitive Groups | |
| 151-200 | Unhealthy | |
| 201-300 | Very Unhealthy | |
| 301+ | Hazardous | |

## 13.3 Water Pollution

### 13.3.1 Quality of Water

Water is essential for life and for the health of the environment. As a valuable natural resource, it comprises marine, estuarine, freshwater (river and lakes) and groundwater environments that stretch across coastal and inland areas. Water has two dimensions that are closely linked: **quantity** and **quality**. Water quality is commonly defined by its physical, chemical, biological and aesthetic (appearance and smell) characteristics. A healthy environment is one in which the water quality supports a rich and varied community of organisms and protects public health.

### 13.3.2 Water Pollution

Water pollution occurs when there is a change in the chemical, physical or biological quality of water that has harmful effect(s) on living organisms that consume it or live in it.

Water pollution adversely affects water bodies due to the large amounts of natural or man-made materials let into it. When it becomes unfit for its intended use, water is considered polluted.

### 13.3.3 Sources of Water Pollution

Even though water bodies or sources can be polluted by natural causes, water pollution is usually caused by human activities. There are three main types of sources: point sources, non-point sources, leaks and spills.

**Point sources:** Discharge of pollutants at specific locations through pipelines or sewers into the water body. Factory effluents, sewage, underground mines, oil wells, oil tankers and agriculture are common point sources **(Fig. 13.2 a)**.

**Non-point sources:** Sources that cannot be traced to a single site of discharge like acid rain, dumping of the plastics in water bodies, agriculture chemical run off are common examples **(Fig. 13.2 b)**.

(a)

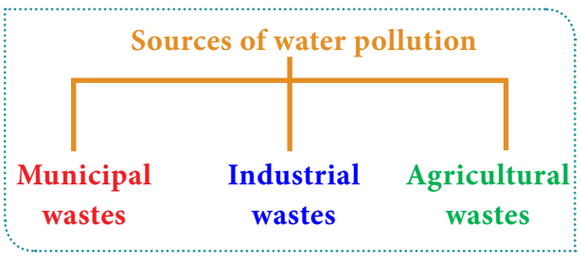
(b)

(c)

**Fig 13.2 Sources of water pollution**

**Leaks and Spills:** This occurs mostly due to ship collision, off shore oil rigs, oil leakages and discharges into sea **(Fig. 13.2 c).**

Sources of water pollution can also be classified in three ways. They are municipal wastes, industrial wastes, and agricultural wastes.




1. Municipal waste water is from homes and commercial establishments.
2. Industrial discharge (effluents) may contain varieties of compounds such as heavy metals (cadmium, chromium, lead), and organic / inorganic chemicals containing waste water, sometimes in toxic concentrations. These discharges can affect temperatures of the water bodies as well as dissolved oxygen level.
3. Agricultural wastes include fertiliser and pesticide runoff from agricultural fields, food processing waste, tree and saw dust from logging operations and bacteria from sewage or livestock operations.

Water pollutants reach water bodies like rivers, streams and the marine system by precipitation, run-off and the groundwater by seepage or percolation.

### 13.3.4 Effect of Water pollution on Ecosystems

1. **Destruction of ecosystems:** Ecosystems, especially aquatic systems, can be severely affected or destroyed by water pollution.Water pollutants affect existing niches and habitats and the survival of organisms. Soil fertility is affected and the system becomes uninhabitable.
2. **Disruption of food-chains:** Water pollution disrupts the natural food chains as well as food webs. Pollutants such as lead and cadmium are taken up by primary consumers where they can be lethal or get stored. Later, when these animals are consumed by secondary consumers, the food chain can get disrupted at any trophic level or result in enhanced concentration of these pollutants (biomagnification). Hot water from industries when released into the water bodies affects aquatic density and diversity.

### 13.3.5. Effect of Water pollution on Organisms

1. Water pollution can be lethal to aquatic organisms and others that depend on these water bodies.

Accidental oil spills from tanker ships can cause substantial environmental damage. Oil

spreads on the water surface, prevents the entry of light and oxygen into the water. This increases BOD and COD, resulting in mass death of organisms and degradation of water quality. It also clogs fish gills and the feathers of aquatic birds.

On January 28, 2017, two cargo ships collided off the Ennore coast in Chennai causing oil to spill into the sea. Due to wave action and the southern current, the spill spread over to 34 km down south affecting the coast. Beach sand also got spoiled by the oil sludge. It took more than a thousand volunteers to clean the oil sludge.

2. Humans and other organisms can get affected by diseases such as hepatitis and typhoid by consuming contaminated water and food. Excess of fluoride in drinking water causes fluorosis. In many poor nations, outbreak of water borne diseases and epidemics are a result of contaminated water and poor or absence of water treatment processes.
3. Water pollution can cause eutrophication due to nutrient enrichment. This causes algal blooms which affect the quality of water bodies **(Fig. 13.3)**. Red tides, if occur, can be lethal to aquatic organisms.

**Fig. 13.3 Algal bloom**

### 13.3.6 Control Measures

1. Right to clean water is a fundamental right under the Indian Constitution.
2. Water (Prevention and Control of Pollution) Act, 1974, sections 17 to 40 prohibit the pollution of a stream or well by disposal of polluting matter.
3. The Central/State Pollution Control Boards have the power to advise the central/state government on various matters concerned with the prevention and control of pollution of water.
4. The Ministry of Environment, Forest and Climate Change (MoEFCC) is the nodal agency of the Central Government for the planning, promotion, co-ordination and for overseeing the implementation of India's environmental and forestry policies and programmes.

### Prevention

- Regulate or control of pollutant(s) discharge at the point of generation.
- Wastewater can be pretreated by scientific methods before discharge to municipal treatment sources.
- Setting up of Sewage Treatment Plants (STP) and Effluent Treatment Plants (ETP).
- Regulate or restrict the use of synthetic fertilisers and pesticides.
- Public awareness and peoples' involvement is essential.

**Assessment by CPCB**

The number of polluted stretches in India's rivers has increased to 351 from 302 (in 2006), and the number of critically polluted stretches – where water quality indicators are the poorest – has gone up to 45 from 35 (Source: The Hindu, 17 September, 2018).

## Case study

**Namami Gange (National Mission for Clean Ganga) Programme** is an Integrated Conservation Mission approved as the 'Flagship Programme' of the Union Government in June 2014 with a budget outlay of 20,000 crores to accomplish the twin objectives of effective abatement of pollution, conservation and rejuvenation of River Ganga.

# 13.4 Noise Pollution

Sound that is unwanted and undesirable or can disrupts one's quality of life is called as Noise. When there is lot of 'noise' in the environment, it is termed as Noise Pollution. The intensity of noise is meaured in **decibels** (dB).

## 13.4.1 Sources of Noise Pollution

Vehicle engines, air horns, audio video systems, trains, low flying aircrafts, factory machines, sirens, motors, drillers and crushers, compressor machines, crackers, explosives, modern supersonic transports are the common sources of noise pollution.

The threshold of pain is about 120 db. World Health Organization has proposed that noise must be recognized as a major threat to human well-being. This is applicable for all living organisms.

## 13.4.2 Effect of Noise Pollution

- According to the USEPA (United States Environmental Protection Agency) there are direct links between noise and health. Heart disease, high blood pressure, stress related illness, sleep disruption, hearing loss (deafness), and productivity loss are the problems related to noise pollution.
- Increased stress and tension, nervousness, irritability, anxiety, depression and panic attacks.
- Peptic ulcer, severe head ache, memory loss.
- Marine animals are affected by noise pollution from offshore activities and port activities.
- Fire crackers frighten animals. Birds are often affected by increased air traffic.

## 13.4.3 Control

- Planting trees in and around noise sources is an effective solution for noise pollution as plants are known to absorb noise and bring down sound levels.
- Regular servicing and tuning of automobile engines can effectively reduce noise pollution by vehicles and machinery.
- Workers should be provided with ear plugs and earmuffs at work sites that generate high noise levels.
- Lubrication of machinery and regular servicing minimizes noise levels.
- Regulations should be imposed to restrict the usage of loudspeakers in crowded areas and public places.

## 13.4.4 Legal Protection

Article 48-A and Article 51-A of the Constitution of India, Noise Pollution (Regulation and Control) Rules 2000, and Tamil Nadu State Environment Policy 2017 are some of the legal relief from noise pollution.

According to Noise Pollution (Regulation and Control) Rules, 2000, the permissible limit of noise in areas categorized as commercial is 65 decibels (dB) during day and 55 dB during night.

# 13.5 Agrochemicals

Chemicals which are used in agriculture for growth of plants and pest control are called agrochemicals or agrichemicals.

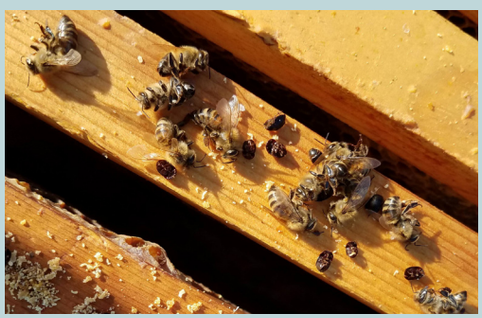
Overuse of agrochemicals have been observed to generate residues that cause nutrient imbalance, and

- May kill beneficial bacteria and soil organisms.
- Can cause eutrophication in water bodies.
- Affect aquatic animals and their productivity.
- Pesticide containing water, even in trace quantities is unfit for human consumption.
- Particles (aerosols) and residues of these chemicals cause air pollution.
- Inhalation of contaminated air can cause respiratory problems.
- Consumption can lead to poisoning, side effects and after effects.
- Chemicals can cause skin rashes and irritation of eyes.
- Many of these chemicals are reported to be carcinogenic.
- They can trigger hormonal disorders and neurotoxicity.
- Beneficial insects and animals can be affected.

**1. Mosquito Repellents**

DEET (n-n-diethylnetatoluamide) and allethrin used in mosquito coils may cause itching, burning, tingling sensation or numbness.

2. **Colony collapse syndrome** in Honey bees due to pesticides/herbicides can lead to destruction of hives and lower agricultural productivity. **!!Remember bees are Nature's best pollinators!!**



## 13.6 Biomagnification

Food chains are components of all ecosystems. Producers and consumers form trophic levels in a chain through which energy flow is carried out by the process of eating and being eaten. Usage, storage and transformation of food and biomolecules by metabolism are a normal process. Degradation or breakdown is an essential part of any food chain and hence all naturally occurring substances are degradable.

### Biomagnification of DDT

When non-degradable substances enter the food chain, they do not get metabolized or broken down or expelled and instead get transferred up the tropic levels of the food chain. During this process, they show an increase in concentration which is referred to as **biomagnification**. This results in increased toxicity and may even be lethal. This phenomenon is well established for mercury and DDT. **Figure 13.4** schematically shows biomagnification of DDT in an aquatic food chain where the concentration of DDT is enhanced at successive trophic levels.

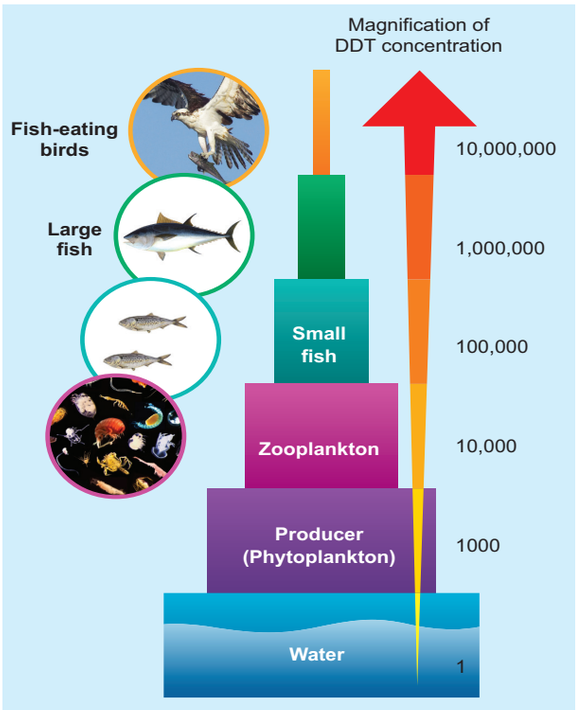



**Fig. 13.4 Biomagnification**

## 13.7 Eutrophication

When run-off from land containing nutrients reaches water bodies like lakes, it results in dense growth of plant life. This phenomenon is called **Eutrophication**. Natural aging of lakes also leads to nutrient enrichment of its water. In a lake, the water is cold and clear (**oligotrophic stage**), supporting little life. With time, streams draining into the lake introduce nutrients such as nitrates and phosphates, which encourage the growth of aquatic organisms. Aquatic plants and animal life grow rapidly, and organic remains begin to be deposited on the lake bottom (**mesotrophic stage**) **(Fig. 13.5).**

Pollutants from anthropogenic activities like effluents from the industries and homes can radically accelerate the aging process. This phenomenon is known as **Cultural** or **Accelerated Eutrophication.**

Nutrients stimulate the growth of algae, water hyacinth and can cause clogging of canals, rivers and lakes as well as, displacing native plants. It causes unsightly foam and unpleasant odours, and deprives the water of dissolved oxygen.

### 13.7.1 Integrated Wastewater Management

#### Wastewater Treatment

Wastewater or sewage originates from domestic waste waters, industrial wastes and animal wastes. Realizing the importance of clean potable water, the Government passed the Water (Prevention and Control of Pollution) Act in 1974, which made it mandatory to treat wastewater in treatment plants. The treatment can be carried out by three ways:

1. Physical methods
2. Chemical methods
3. Biological methods

**1. Physical methods of wastewater treatment**

Wastewaters containing insoluble substances or colloids are treated through processes such as flotation, sedimentation, filtration and centrifugal separation.

**2. Chemical methods of Wastewater treatment**

Chemical methods of wastewater treatment include:

- Generation of insoluble solids.
- Produce an insoluble gas.
- Produce biologically degradable substances from a non-biodegradable substance.
- Oxidize or reduce to produce a non-objectionable substance.

**3. Biological methods of Wastewater treatment**

(1) Bioremediation of wastewater includes the aerobic treatment (oxidation ponds, aeration lagoons) and anaerobic treatment (anaerobic bioreactors, anaerobic lagoons).

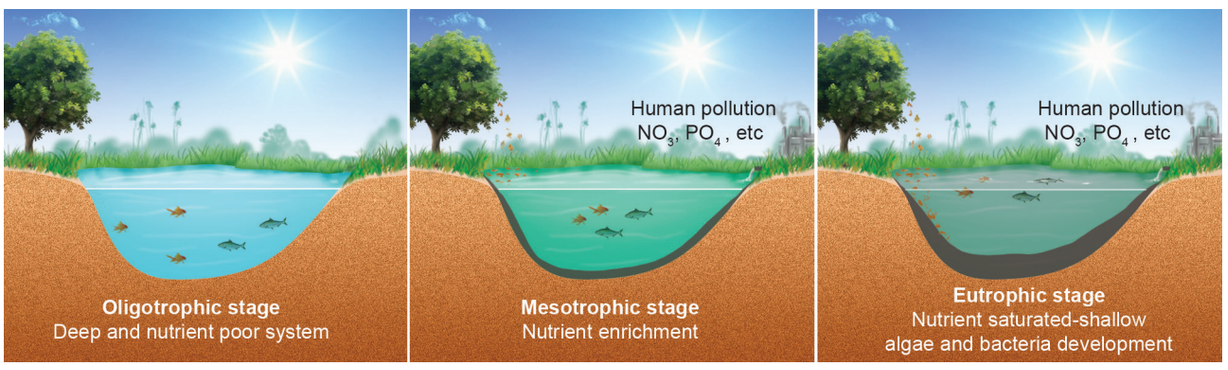



**Fig. 13.5 Stages of Eutrophication**

(2) Phytoremediation of wastewater includes constructed wetlands, Root Zone Wastewater Treatment (RZWT), and Decentralized Waste Water Treatment System (DEWATS) **(Fig. 13.6 a)**.

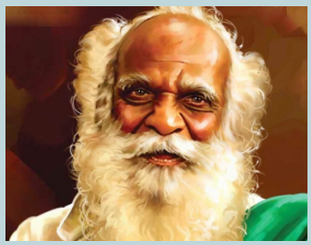
**Fig .13.6 (a) DEWATS system at Auroville**

**(b) RZWT system at Aravind Eye Hospital**

*Case Study:* Auroville, located in South India near Puducherry has been experimenting with natural wastewater recycling systems (Fig:13.6a). Such treatment plants have now also been implemented in Aravind Eye Hospital, Puducherry **(Fig.13.6 b)** and the Chennai Mathematical Institute, Siruseri IT Park, Chennai.

## 13.8 Organic Farming and Its Implementation

It is a method of farming system which primarily aims at cultivating the land and raising crops in such a way, so as to keep the soil alive and in good health by use of organic wastes (crop, animal and farm wastes, aquatic wastes) and other biological materials along with beneficial microbes (biofertilizers) to release nutrients to crops for increased sustainable production in an eco-friendly pollution free environment.



**G. Nammalvar** was a supporter and expert of **organic farming**. He was an agricultural scientist, environmental activist celebrated for his work on spreading **Ecological farming** & **Organic farming**. He was against the use of chemical fertilisers and pesticides. He trained hundreds of farmers in natural farming. Nammalvar was the author of several **Tamil** and **English** books on natural farming, pesticides & fertilisers and was featured in magazines & television programs. He founded the Nammalvar Ecological Foundation for Farm Research and Global Food Security Trust or simply **Vaanagam** at Karur, Tamilnadu. He developed social forest at Ammankurai and the Kolunji Ecological Farm in Pudukottai. He and his friends made a 10-acre barren land into fertile cultivable land in the dry Pudukottai district. He planted 52 varieties of trees in the same waste land extending in 20 acres. His organization 'Kudumbam' preserves and regenerates hundreds of native flora and fauna, in order to ensure a sustainable livelihood.

## 13.9 Solid Waste Management

Every day, tonnes of solid wastes are disposed off at landfill sites. This waste comes from homes, offices, industries and various other agricultural related activities. These landfill sites produce foul smell if waste is not stored and treated properly. When hazardous wastes like pesticides, batteries containing lead, cadmium, mercury or zinc, cleaning solvents, radioactive materials, e-waste and plastics are mixed up with paper and other scraps and burnt, they produce gases such as dioxins. These gases are toxic and carcinogenic. These pollute the surrounding air, ground water and can seriously affect the health of humans,

wildlife and our environment. The following are major sources of solid waste **(Table 13.1).**

**Dr. Sultan Ahmed Ismail** is an Indian soil biologist and ecologist from Tamil Nadu. His work has centered on techniques for recycling biodegradable waste into fertiliser using varieties of earthworms, and on soil bioremediation.

Dr. Ismail received a D.Sc. in Zoology from the University of Madras for his research on the role of earthworms in soil ecology and waste management. He works on vermicomposting as a sustainable ecological practice. He has been instrumental in introducing as well as spreading awareness on environmental issues, solid waste management, vermicomposting, organic farming, vermitech and waste management to several educational institutions, industries and organic farmers in India and abroad.

Solid Waste management includes the activities and actions required to manage waste from its inception to its final disposal. This includes the collection, transport, treatment and disposal of waste, together with monitoring and regulation of the waste management process. It is all about how solid waste can be changed and used as a valuable resource.

***Case Study:*** The Corporation of Chennai looks after clearance and management of solid waste in Chennai. Every day around 5400 Metric Tonnes (MT) of garbage is collected from the city. Door to door collection of garbage is done in most zones apart from sweeping, collecting, and storing the waste in the specified bins. At present garbage generated in Chennai is dumped at two sites. Proposals are there for remediation of the existing landfill or scientific closure and to have integrated waste processing facilities with waste to energy plants as one of the components at the existing Kodungaiyur and Perungudi sites.

### 13.9.1 Waste management practices

a) Source segregation

b) Composting

1. Aerobic 2. Anaerobic

**Table 13.1** Major sources of solid waste

| Waste category | Source |
|---|---|
| **Residential** | Food wastes, plastics, paper, glass, leather, cardboard, metals, yard wastes, ashes, tires, batteries, old mattresses |
| **Industrial** | Packaging wastes, ashes, chemicals, cans, plastics, metal parts |
| **Commercial** | Thin and thick plastics, food wastes, metals, paper, glass, wood, cardboard materials |
| **Institutional** | Wood, paper, metals, cardboard materials, electronics |
| **Construction and Demolition** | Steel materials, concrete, wood, plastics, rubber, copper wires, dirt and glass. |
| **Agriculture** | Agricultural wastes, spoiled food, pesticide containers |
| **Biomedical** | Syringes, bandages, used gloves, catheter, urine bags, drugs, paper, plastics, food wastes, sanitary napkins and diapers, chemicals. |
| **E-Waste** | Electronic items like used TVs, transistors, tape recorders, computer cabinets, mother boards, CDs, cassettes, mouse, wires, cords, switches., chargers. |

c) Vermicomposting
d) Biogas generation
e) Incineration

### 13.9.2 Radioactive waste

Radioactive wastes are generated during various operations of the nuclear power plant. Radioactive waste can be in gas, liquid or solid form, and its level of radioactivity can vary. The waste can remain radioactive for a few hours or several months or even hundreds of thousands of years. Depending on the level and nature of radioactivity, radioactive wastes can be classified as exempt waste, Low and Intermediate level waste and High Level Waste.

### Radioactive waste management

Radioactive waste management involves the treatment, storage, and disposal of liquid, airborne, and solid effluents from the nuclear industry.


The Three Mile Island (Pennsylvania, United States), Chernobyl (Pripyat, Ukraine) and Fukushima Daiichi (Ōkuma, Japan) are nuclear disasters the world has seen in the recent period.

### Methods of disposal of radioactive wastes are

1. Limit generation - Limiting the generation of waste is the first and most important consideration in managing radioactive wastes.
2. Dilute and disperse - For wastes having low radioactivity, dilution and dispersion are adopted.
3. Delay and decay - Delay and decay is frequently an important strategy because much of the radioactivity in nuclear reactors and accelerators is very short lived.
4. Concentrate and confine process - Concentrating and containing is the objective of treatment activities for longer-lived radioactivity. The waste is contained in corrosion resistant containers and transported to disposal sites. Leaching of heavy metals and radionuclides from these sites is a problem of growing concern.

### Control and Management

Three ways are employed to manage nuclear wastes

- **Spent Fuel Pools** - The spent fuel discharged from the reactors is temporarily stored in the reactor pool. The Spent fuel rods are used in stored cooling ponds. They protect the surroundings from radiation and absorb the heat generated during radioactive decay.
- **Vitrification method** – This prevents reaction or degradation of nuclear waste for extended periods of time and encased in dry cement caskets.
- **Geological Repositories** - A deep geological repository is a nuclear waste repository excavated deep within a stable geologic environment. It is suited to provide a high level of long-term isolation and containment without future maintenance. In India at Tarapur and Kalpakkam, a wet storage facility of Spent Fuel is the main mode of storage.

### 13.9.3 Medical waste

Any kind of waste that contains infectious material generated by hospitals, laboratories, medical research centers, Pharmaceutical companies and Veterinary clinics are called medical wastes.

Medical wastes contain body fluids like blood, urine, body parts and other contaminants, culture dishes, glasswares, bandages, gloves, discarded needles, scalpels, swabs and tissues.

**Management:** The safe and sustainable management of biomedical waste is the social

and legal responsibilities of people working in healthcare centers.

**Waste disposal:** Involved by incineration, chemical disinfection, autoclaving, encapsulation, microwave irradiation are methods of waste disposals. Final disposal includes landfill and burying as per norms inside premises.

### 13.9.4 E-Waste

Electronic waste or e-waste describes discarded electrical electronic devices as well as any refuse created by discarded electronic devices and components and substances involved in their manufacture or use. Their disposal is a growing problem because electronic equipment frequently contains hazardous substances. In a personal computer, for example, there may be lead (Pb) in the cathode ray tube (CRT) and soldering compound, mercury (Hg) in switches and housing, and cobalt (Co) in steel components, among other equally toxic substances. E-wastes are basically PCB (Polychlorinated biphenyl) based, which are non-degradable (**Fig.13.7**).

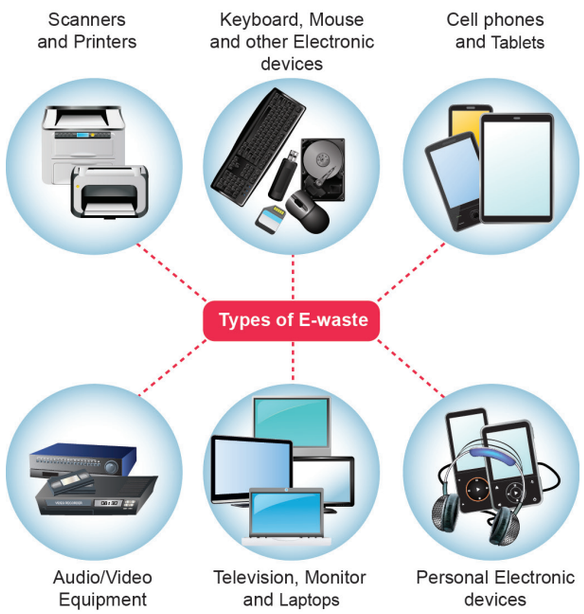



**Fig.13.7** Types of E-wastes

Used electronics which are destined for reuse, resale, salvage, recycling, or disposal are also considered e-waste. Unauthorised processing of e-waste in developing countries can lead to adverse human health effects and environmental pollution.

Recycling and disposal of e-waste may involve significant risk to the health of workers and communities in developed countries and great care must be taken to avoid unsafe exposure in recycling operations and leaking of materials such as heavy metals from landfills and incinerator ashes.

### 13.9.5 Plastic Waste – Solutions and Remedies

Plastics are low molecular weight organic polymers that are non-degradable in the natural environment. They are used in several items, including cars, bulletproof vests, toys, hospital equipment, carry bags and food containers. Packaging materials used in supermarkets, retail outlets, manufacturing industries, households, hotels, hospitals, restaurants and transport companies are major contributors to plastic waste generation. Plastic waste constitutes a major part of municipal solid waste.

- Remedies: '4R'- Refuse, Reduce, Reuse and Recycle mantra is the best available remedy for plastic waste pollution.
- Tamil Nadu State government successfully implemented the ban on single use plastics from 1st January 2019.

## 13.10 Global Environment Change

### Green House Effect and Global warming

Natural environment and climate are dynamic and keep changing over course of time. But with human population growth, industrialization and associated anthropological activities the changes are more pronounced and impactful in a much shorter time span, thus resulting in drastic Global environmental change.

Large-scale changes of global environment can lead to hazards, which may include climate change, stratospheric ozone depletion, changes

in ecosystems due to loss of biodiversity, changes in hydrological systems and the supplies of freshwater, land degradation, urbanization, and stress on food-producing systems.

Greenhouse gases (GHG) water vapour, carbon dioxide, methane, nitrous oxide, ozone and some artificial chemicals such as chlorofluorocarbons (CFCs) causes greenhouse effect. The absorbed energy warms the atmosphere and the surface of the Earth.

**Major International Environmental Conventions**

1972: UN conference on Human environment, Stockholm, Sweden
1972: UN environment programme (UNEP), Stockholm, Sweden
1987: Montreal Protocol, Vienna
1989: Intergovernmental panel on climate change, Geneva, Switzerland.
1992: Earth summit, Rio de Janeiro. Agenda 21, otherwise called Rio conference, Brazil
1997: Kyoto Protocol, Japan
2002: World Summit on Sustainable Development, Johannesburg, South Africa
2003: World climate change conference, Moscow, Russia
2012: UN Conference on Sustainable Development, Rio de Janeiro
2015: UN Sustainable Development Summit, New York
2016: Montreal Protocol amendment at Kigali, Rwanda
2017: The COP23 climate change summit in Bonn, Germany
2018: UN climate change conference, Katowice, Poland

- The large-scale global warming will have significant impact on people and nature. As global average temperatures rise, precipitation patterns could be affected. Extreme wet and dry conditions can be expected (flooding and desertification). Coastal areas shall become more vulnerable to storm surges as sea level rises. Plant and animal species will migrate or disappear in response to climate change.
- Global warming can directly affect the flora and fauna. This could also result in shortage of food and even lead to food crisis; and affect the health of the people and organisms.

Climate change threatens Nilgiri Tahr: The endangered wild goat could lose approximately 60 % of its habitat, starting from the 2030s. (The Hindu, 12.08.2018)

The UNO has several measures to control or reduce pollution. Through various conventions organized by UNO, the countries assured to take steps to control or reduce emissions by factories and automobiles.

## 13.11. Impact on Specific Ecosystems

### 13.11.1 Marine Ecosystem

The marine ecosystem (**Fig. 13.8**) is the source of fish, see weeds and other marine products. With the advent of intensive fishing by using giant nets and mechanized boats, fish catch has dropped significantly.

**Fig. 13.8: Marine ecosystem**

## 13.12 Ozone Depletion

At about 15 and 30 kilometers from the ground level, the earth's atmosphere has a thin layer of ozone, which absorbs ultraviolet sunlight. Ozone is found in the layer of the atmosphere called the Stratosphere. It acts as a protective covering that absorbs ultraviolet (UV) radiation from the sun. The ozone molecule ($O_3$) consists of three oxygen atoms. It is formed when atmospheric oxygen ($O_2$) on exposure to solar radiation breaks into two oxygen atoms; each atom then joins up with a single oxygen atom. The ozone molecule is unstable. It soon decays again to form molecular oxygen. This cycle is a continuous process in the upper reaches of the stratosphere.

**World Ozone Day**

September 16 has been designated by the United Nations as the International Day for the Preservation of the Ozone Layer.

The ozone layer was discovered in 1913 by the French physicists Charles Fabry and Henri Buisson.

### Causes and effects of ozone layer depletion

*Causes*: Ozone layer depletion mainly occurs by anthropogenic actions.

The excessive release of chlorine and bromine from man-made compounds such as chlorofluorocarbons (CFCs) causes ozone layer depletion. CFCs, methyl chloroform, carbon tetrachloride, hydrochlorofluorocarbons, hydrobromofluorocarbons and methylbromide are found to have direct impact on the depletion of the ozone layer. These are categorized as ozone-depleting substances (ODS).

*Effects:* UV rays may penetrate deep into the skin and can lead to premature skin aging and wrinkling of skin; suppression of the immune system, skin cancer (melanoma) and chronic effects leading to eye damage. DNA damage can result from free radicals and reactive oxygen and photons can damage the DNA itself.

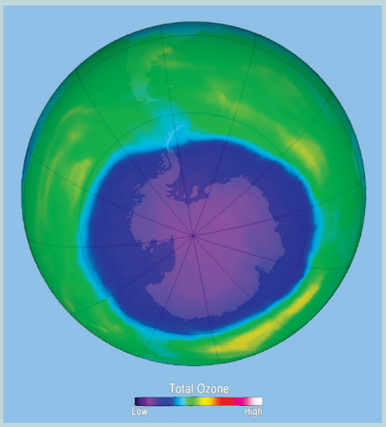
*Control:* Ozone layer depletion can be controlled by

(1) Phase down or ban the use of CFCs (CFC free refrigerants).

(2) Minimizing the use of chemicals such as halons and halocarbons.

(3) Creating awareness about ozone depleting agents.

Ozone hole (in purple colour), is the area above Antarctica, where the ozone layer is the thinnest.




**Ozone depletion around Polar region**

Ozone thickness is given in Dobson unit (see carefully the scale shown in colour from violet to red). The ozone hole over Antarctica develops each year between late August and early October.

Courtesy: NASA

## 13.13 Deforestation

Deforestation is the destruction of forests in order to clear the land and make it available for other uses. Forests cover about 30 percent of the world's landmass. But due to deforestation it is estimated that the earth loses 18.7 million acres of forests per year. In 2016, global tree cover loss reached a record of 29.7 million hectares.

Common methods of deforestation are burning trees and clear cutting.

## 13.14 People's Participation in Conservation of Forests

People's participation is vital in forest conservation, especially those living in them or close to the forest. This is referred to as Community forestry, which varies widely in legal, political and cultural settings and the term covers a wide range of experiences and practices.

The Bishnois, who are known conservators of their forest, were inspiration to many people's participatory movements for Environmental protection in India. The **Chipko movement** resisted the destruction of forests of India in the 1970s. **Sunderlal Bahuguna** was the leader of this movement. People in the movement hugged the trees, and prevented felling of trees by contractors.

The 'Forest man of India', **Jadav Payeng** who created 1,360 acres of dense and defiant forest was born in Arunasapori (a river island on the Brahmaputra). He had just completed his Class X exams in1979 when he started to sow the seeds and shoots on the eroded island covered with sand and silt. Thirty-six years later he had converted the once unproductive land into a forest. Payeng's forest is now home to five Royal Bengal tigers, over a hundred deer, wild boar, vultures, and several species of birds. For his remarkable initiative, the Jawaharlal Nehru University invited Payeng in 2012 on Earth Day and honoured him with the title of the 'Forest Man of India'. Later, the President APJ Abdul Kalam felicitated him with a cash award in Mumbai. The same year, he received the 'Padma Shri'.

The Indian Constitution also stresses on the importance of the role of the People in protecting their environment.

Amrita Devi was a brave lady from Khejarli Village of Jodhpur District, Rajasthan. She sacrificed her life to maintain Bishnoi Dharma. In 1730, Maharaja Abhay Singh, ruler of Marwar, Rajasthan state wanted to log green Khejri *(Prosopis cineraria)* trees to burn lime for the construction of his new palace. Since there was a lot of greenery in the Bishnoi villages even in the middle of Thar Desert, the king ordered his men to get the wood from Khejri trees. When she came to know about the cutting of trees by the King's men, she and many others had hugged the Khejri trees to save from cutting. But king's men killed Amrita Devi along with more than 363 other Bishnois. It was a Tuesday, black Tuesday in Khejarli. This incident took place to save trees and is recorded in India's history.

To commemorate her bravery, the Government of Rajasthan and Madhya Pradesh have initiated the prestigious state level award named as 'Amrita Devi Bishnoi Smriti Award' for excellent contribution to the protection and conservation of wildlife.

## 13.15 Ecosan Toilets

About 150 liters of wastewater at an average is generated by an Indian individual daily, and a large amount of it is generated from toilets. Ecological sanitation (EcoSan) is a sustainable system for handling human excreta by using dry composting toilets. EcoSan toilets not only reduce wastewater generation but also generate the natural fertiliser from recycled human excreta, which forms an excellent substitute for chemical fertilisers. This method is based on the principle of recovery

and recycling of nutrients from excreta to create a valuable supply for agriculture. 'EcoSan' toilets are being used in several parts of India and Sri Lanka.

## Summary

Degrading natural environments, depleting natural resources, pollution, vulnerability to large scale environmental changes and hazards are the core Environmental issues of today.

Air pollution by fossil fuel burning and other anthropological activities like industrialization is reaching alarming levels and affecting human health and testing the survival of sensitive species.

Domestic and industrial sewage, and agricultural run-off are the most common reasons for pollution of water bodies, resulting in reduced dissolved oxygen and increased Biochemical Oxygen demand of water bodies. Eutrophication and algal blooms are regular occurrences today. Industrial wastewaters are often rich in toxic chemicals, heavy metals and organic compounds which harm living organisms and may even result in death of aquatic life.

Noise pollution is a threat to human and other animals. It can affect health and disturb peaceful habitats. Agrochemicals and its usages cause many ill effects in human beings, other organisms and soil. Agrochemicals can also cause biomagnification. The solution is to revert to non-chemical farming (use of biofertilisers, biopesticides, protect pollinators) practices.

Generation of municipal wastes and their safe disposal are major issues faced by communities today. Solid wastes create environmental problems and must be disposed-off in safe ways. Disposal of solid wastes, radioactive wastes and e-wastes requires further efforts and research. Solid wastes like plastic can be combated by practicing the 4R - refuse, reduce, reuse and recycle. Ecosan toilets are some of the universally accepted eco-friendly practices.

Green house effect and depletion of ozone layer are aggravated by emissions of carbon dioxide, methane, nitrous oxide and CFCs and deforestation. Melting of ice caps, rising sea levels, change in rainfall patterns, increase in average global temperature, are deleterious to living organisms. Increased risks of skin cancer, mutations and other disorders are potential threats.

Earth summits, Conventions on climate change, developing of protocols and creation of emission standards and control are some of the steps taken by governments towards protecting our environment and conserve for today and the future generations.

ZSQXQY

## Evaluation

1. Right to Clean Water is a fundamental right, under the Indian Constitution
   a) Article 12 **b) Article 21**
   c) Article 31 d) Article 41
2. With which of the following, the Agenda 21' of Rio Summit, 1992 is related to?
   a) Sustainable development
   **b) Combating the consequences of population**
   c) Mitigation norms of Green House Gases (GHGs) emission.
   d) Technology transfer mechanism to developing countries for 'clean-energy' production.
3. Which among the following awards instituted by the Government of India for individuals or communities from rural areas that have shown extraordinary courage and dedication in protecting Wildlife?
   a) Indira Gandhi Paryavaran Puraskar
   b) Medini Puruskar Yojana
   **c) Amrita Devi Bishnoi Award**
   d) Pitambar Pant National Award
4. The 'thickness' of Stratospheric Ozone layer is measured in/on:
   a) Sieverts units **b) Dobson units**
   c) Melson units d)Beaufort Scale
5. Which among the following is the most abundant Green-House-Gas (GHG) in the earth's atmosphere?
   a) Carbon dioxide **b) Water Vapour**

c) Sulphur Dioxide d) Tropospheric Ozone

6. As per 2017 statistics, the highest per capita emitter of Carbon dioxide in the world is
   a) USA **b) China**
   c) Qatar d) Saudi Arabia
7. The use of microorganism metabolism to remove pollutants such as oil spills in the water bodies is known as
   a) Biomagnification **b) Bioremediation**
   c) Biomethanation d) Bioreduction
8. The Ozone Day is observed every year on September 16 as on this day in 1987 the _____was signed for launching efforts to arrest the depletion of the fragile ozone layer in the stratosphere that prevents the harmful ultra-violet rays of the sun from reaching the earth. Fill the correct word in blank.
   **a) Montreal Protocol** b) Geneva Protocol
   c) Kyoto Protocol d)Nagoya Protocol
9. Which among the following always decreases in a Food chain across tropic levels?
   a) Number b)Accumulated chemicals
   **c) Energy** d) Force
10. In the E-waste generated by the Mobile Phones, which among the following metal is most abundant?
    **a) Copper** b) Silver
    c) Palladium d) Gold
11. The Hydrochlorofluorocarbons (HCFCs) are the compounds which have the following molecules:
    a) Hydrogen b) Carbon
    **c)Chlorine** d)Fluorine
12. SMOG is derived from :
    a) Smoke b) Fog
    **c) Both A and B** d) Only A
13. Excess of fluoride in drinking water causes:
    a) Lung disease b) Intestinal infection
    **c) Fluorosis** d) None of the above
14. Expand (i) CFC (ii) AQI (iii) PAN
15. What is SMOG and how it is harmful for us?
16. List all the wastes that you generate, at home, school or during your trips to other places. Could you very easily reduce the generation of these wastes? Which would be difficult or rather impossible to reduce?
17. Discuss the causes and effects of global warming. What measures need to be taken to control global warming?
18. What would Earth be like without the greenhouse effect?
19. Write notes on the following:
    a. Eutrophication
    b. Algal Bloom
20. What effect can fertilizer runoff have on an aquatic ecosystem?
21. How can we control eutrophication?
22. Why does ozone hole form over Antarctica?
23. Mention the causes of enhanced use of ultraviolet radiation.
24. Discuss the role of women in protection and conservation of forests.
25. Discuss the role of an individual to reduce environmental pollution.
26. How does recycling help reduce pollution?
27. What is the primary purpose of the Kyoto Protocol?
28. In what way Peyang conserves the forest?
29. Discuss briefly the following :
    a. Catalytic converter
    b. Greenhouse gases
    c. Ecosan
30. What are some solutions to toxic dumping in our oceans?
31. Describe how deforestation might contribute to global warming.
32. How does forest conservation help to reduce air pollution?

# Glossary


**Abiogenesis –** The emergence of life forms emerging from non-living chemical systems. In contrast with spontaneous generation, abiogenesis is not a process that biologists think continues in a particular environment, such as a planet or moon, once a living system has emerged.

**Acidogenesis –** Conversion of simple organic materials into acetate, H2 and CO2 by acidogenic bacteria.

**Algal bloom –** Presence of large amounts of nutrients in waste water causing excessive growth of planktonic algae.

**Allergy -** A hypersensitivity reaction that can involve various deleterious effects.

**Anthropogenic causes–** Problems created by human

**Anthropology –** The study of differences and similarities, both biological and cultural, in human populations. Anthropology is concerned with typical biological and cultural characteristics of human populations in all periods and in all parts of the world.

**Antisense DNA–** It is the non coding strand complementary to the coding strand in double stranded DNA. The antisense strand serves as a template for mRNA synthesis.

**Apoptosis–** Is a form of programmed cell death that occurs in multicellular organisms.

**Attenuated –** reduced in virulence.

**Autoradiography –** It is the use of X-ray or photographic film to detect radioactive materials.

**Bacteriophages–** Viruses which infect bacterial cells.

**Biogeography -** The scientific study of the geographic distribution of organisms.

**Canopy –** The canopy is the above ground portion of a plant community or crop, formed by the collection of individual plant crowns.

**Carcinogens–** Substance causing cancer

**Cardiac arrhythmia–** Any variation from the normal rhythm in the heartbeat.

**Carrier –** An individual heterozygous for a recessive gene that is not expressed

**Catastrophic–** Something or substance that involves or causes a sudden terrible disaster.

Changes in animals over time in response to changing environmental factors /conditions. Adaptations help develop physiological, behavioral and structural / functional traits which increase the chances of survival of the organisms.

**Chemical oxygen demand -** A measure of the oxygen required to oxidize soluble and particulate organic matter in water.

**Cirrhosis -** Scarring of the liver that impairs its functioning.

**Co-dominance –** In a heterozygote, the dominant and recessive allele is capable of phenotypic expression.

**Coacervates –** are the microscopic spontaneously formed spherical aggregates of lipid molecules that are held together by electrostatic forces and that may have been precursor of cells. They are the cluster of molecular aggregates in colloidal form which are bounded by a membrane and grows by absorbing molecules from the environment. Oparin believed that life developed from coacervates.

**Cytolysis -** Destruction of cells

**Cursorial –** A cursorial organism is one that is adapted specifically to run. Cursorial organisms are typically adapted to long-distance running at high speeds, rather than animals with high acceleration over short

distances; thus, a cheetah is considered cursorial, while a leopard is not.

**Denaturing –** Denaturing means separation or splitting of the double helix into single stands by breaking hydrogen bonds between the two strands.

**Dendritic cells -** Professional antigen presenting cells that have long membrane processes

**Diapedesis -** The movement of blood cells (leucocytes) out of the circulatory system and towards the site of tissue damage or infection accompanying inflammation.

**Dinosaurs -** a term coined by Sir Richard Owen for giant extinct reptiles. Group of animals that have bird-like and lizard-like facial appearance (Mesozoic).

**Distribution –** The occurrence of different organisms in a given area and the way they are distributed in their space, specific time and utilization of their resources.

**DO –** Dissolved Oxygen is the amount of gaseous oxygen (O2) dissolved in the water.

**Ecotourism -** Travel undertaken to witness sites or regions of unique natural ecological quality the provision of services to facilitate such travel.

**El Nino–** Unusual warming of surface waters in the eastern tropical Pacific Ocean.

**Emphysema–** A serious medical condition that occurs when the lungs become larger and do not work properly, causing difficulty in breathing.

**Endemism-**The phenomenon in which the organisms are exclusively restricted to a given area.

**Endometriosis –** An abnormal condition in which endometrial tissue that normally lines the uterus grows outside .

**Eohippus –** ancestor of modern horse.

**Euchromatin –** Euchromatin is a tightly packed form of chromatin that is enriched in genes, and is often under active transcription.

**Eutrophication -** Excessive richness of nutrients in a lake or other water bodies frequently due to run of fertilizers from the land causing dense growth of plant life.

**Fibroids –** Fibroids are abnormal growths formed on the outside, inside or in the walls of the uterus.

**Foetus –** Developmental stage extending from the ninth week of development to birth.

**Fossorial –** Fossorial (from Latin fossor, meaning "digger") is an animal adapted to digging which lives primarily, but not solely, underground. Some examples are badgers, naked mole-rats, clams, and mole salamanders.

**]Galaxy –** a specific arrangement of stars.

**Gene bank-**A facility established for the ex-situ Conservation of individuals, seeds, tissues or reproductive cells .

**Gene pool –** the total gene content of a whole species.

**Genetic drift –** an alteration in the gene frequency.

**Geology –** the study of origin and structure of Earth.

**Glaciers–** A large mass of ice that moves slowly.

Group of individuals of the same species living in a given area at a given time and reproduce among themselves.

**Haemophilia –** A medical condition in which the ability of the blood to clot is severely reduced, causing the patient to bleed severely from even a slight injury.

**Haemozoin** - Toxic malarial pigment that causes malaria fever.

**Hallucination** - The sensation of seeing, hearing or sensing something that does not exist.

**Heterochromatin** – Heterochromatin is a tightly packed form of DNA or condensed DNA.

**Homeostasis**– It is the state of steady internal conditions maintained by living things.

**Immune reaction** – The production of antibodies in response to antigens

**Interferon** - An antiviral protein produced from virally infected fibroblasts and leucocytes induces antiviral state in uninfected cells.

**Intersex** – An individual showing a combination of male and female characteres.

**Intra**-Uterine Insemination (IUI)-Processed sperm sample is infused into the uterus, by passing the vagina. Intracytoplasmic sperm injection (ICSI)-injection of a sperm directly into the ovum.

**Intra uterine transfer (IUT)**-Transfer of embryo with more than 8 celled blastomeres into the uterus.

**In vitro fertilization (IVF)**- Fertilization outside the body in the laboratory.

**In vivo fertilization** -fusion of gametes within the female

**Inflammation** - e.g., Vaginitis- inflammation in the vagina, urethritis- inflammation in the urethra,endocervicitis- inflammation inside the cervix, epididymitis - inflammation in the epididymis, prostatitis - inflammation in the prostate gland

**Keystone species**-A species whose loss from an ecosystem would cause a greater than average change in other species population or ecosystem process.

**Locus** – The particular point on the chromosome at which the gene for a given trait occurs.

**Macrophage** - A large, leucocyte derived from a monocyte that functions in phagocytosis,

**Malt** - Mucosal Associated Lymphoid Tissue collective terms for secondary lymphoid organs located along various mucous membrane surfaces including Peyer's patches, tonsils, appendix

**Mast cell** - A bone marrow derived cell

**Menarche** – Starting of the first menstrual period.

**Merozoite** - A trophozoite of Plasmodium found in **RBC or** liver cells.

**Methanogenesis** – Conversion of acetate, H2 and CO2 into methane by methane producing bacteria

**Molecular biology** – The branch of biology which attempts to interpret biological events in terms of the physico chemical properties of molecules in a cell.

**Molecular pharming** – Production of active pharmaceutical substances in genetically moldified organisms

**Mould** – an impression of a complete organism or a part of it in the rock that surrounds it.

**Multple sclerosis**– is a demyelinating disease in which the insulating covers of nerve cells in the brain and spinal cord are damaged.

**Mutation** – sudden and inheritable changes.

**Narcotic** - A powerful drug that produced, relaxed, dreamy state, derived from Opium plant.

**Nascent RNA –** Nascent RNA is an immediately formed RNA. In this RNA no post transcriptional modification had occured.

**NBOD –** Nitrogenous BOD

**Nk cells -** Natural Killer cells that kill infected and tumor cells.

**Nondisjunction –** Nondisjunction is the failure of homologous chromosomes or sister chromatids to separate properly during cell division

**NPK fertilizers–** Fertilizers with Nitrogen (N), Phosphorus (P) and Potassium (K).

**Nucleosome –** A morphologically repeating unit of DNA containing 190 base pairs of DNA folded together with eight histone molecules.

**Null cell -** A small population of peripheral blood lymphocytes that lack the membrane markers characteristic of B and T cells. **Natural killer** cells are included in this group.

Number of individuals in a population within a defined unit of space and time.

**Ontogeny –** life history of an individual.

**Oocyte –** The encysted zygote of Plasmodium

**Operon –** A cluster of genes whose expression is controlled by a single operator.

**Panspermia –** units of life in the forms of spores.

**Permafrost –** Any ground that remains completely frozen (32°F (0°C) or colder) for at least two years straight. These permanently frozen grounds are most common in regions with high mountains and in Earth's higher latitudes near the North and South Poles.

**Phenotypicplasticity-**theabilityofonegenotype to produce more than one phenotype when exposed to different environments.

**Phylogeny –** *recalling of* ancestral history.

**Planetesimals -** Planetesimals are the fundamental building blocks of the planets as well as the ancestors of asteroids and comets.

**Polypeptide chain–** It consists of smaller subunits or amino acids that are linked together. They are the building blocks of proteins.

**Postpartum –** Period of life following childbirth.

**Precursor–** A substance from which another is formed, especially by metabolic reaction

**Primer –** A short oligonucleotide that hybridizes the template strand and gives a 3' – OH end for the initiation of nucleic acid synthesis.

**Probe –** The probe is a single stranded DNA molecule that is 'complementary' to the gene of interest in a sample under study.

**Pseudopodia –** Blunt temporary protoplasmic projections found in Amoeba or in some amoeba-like cells.

**Psychoactive drug -** A chemical substance that acts on brain and affects the mind and behaviour of user.

**Puberty –** Period of reproductive maturity

Pyrolysis– Decomposition brought about by high temperatures.

**Recombinant–** A cell or organism whose genetic complement results from recombination

**Redia –** Larva in the life cycle ofmost trematodes.

**Rheoreceptors –** They are receptors in fish and some amphibians that respond to water currents.

**Saltation –** single step large mutation.

**Satellite DNA –** Short highly repeated eukaryotic DNA sequences, usually clustered in heterochromatin and generally not transcribed

**Saltatorial –** Saltatorial is an animal adapted to leaping. They have large, muscular hindlimbs and sometimes, reduced forelimbs. A few example

for jumpers in the animal kingdom include fleas, froghoppers, grasshoppers, and frogs.

**Schizogony** - The process of multiple fission, in which one organism divides to produce many daughter cells.

**Schizont** – The trophozoite of Plasmodium grows in size to form the schizont.

**Selection** – choosing the better adapted alleles from the mixed population.

**Sewage** - Domestic waste water containing various solid and liquid waste materials including human excreta.

**Single cell protein (SCP)** – A protein derived from a culture of single celled organisms used especially as a food supplement.

**SOD**– Sediment Oxygen Demand is the rate at which dissolved oxygen is removed from the water column during the decomposition of organic matter in streambed or lakebed sediments.

**Solubilisation** – Dissolving the feed stock in water to make a slurry for anaerobic digestion.

**Speciation** – formation of new species from the pre-existing ones.

**Structural gene** – A gene coding for the structure of a protein.

**Taq DNA polymerase**– is a thermostable DNA polymerase obtained from thermophilic bacterium Thermus aquaticus. It helps in the synthesis of DNA.

**Transgene**– The target gene responsible for the development of transgenic organism.

**Trophozoite stage** – In Plasmodium life cycle, cryptomerozoites in the RBC become round and it modifies into a young trophozoite.

**Umbilical cord** – Structure bearing arteries and veins connecting the placenta and the foetus.

**Variations** – dissimilarity between the members of the same species.

**Vitrification**– Transformation of a substance into a glass.

**Volatility**– A liquid or substance is one that will quickly change into a gas.

**Withdrawal symptoms** - The reactions experienced by an addict after he/she stops using drugs.

**Woolly mammoth** – A hairy relative of modern elephant that lived in cold climates.

**Zoogeography** – study of details with the geographical distribution of animals.

**Zygote intra fallopian transfer**-(ZIFT) transfer of zygote or embryo with 8 or less than 8 celled blastomeres into the fallopian tube.

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# MCQs for Higher Studies

## Chapter 1 - Reproduction in Organisms

1. "Nothing lives forever, but life continues". What does it mean? [AIPMT 1995]
   **a) Older dies but new ones are produced by reproduction**
   b) Nothing can produce without death
   c) Death has nothing to do with the continuation of life
   d) Parthenogenesis is must for sexual reproduction
2. A few statements describing certain features of reproduction are given below. Select the options that are true for both sexual and asexual reproduction from the options given:
   i. Gametic fusion takes place
   ii. Transfer of genetic material takes place
   iii. Reduction division takes place
   iv. Progeny have some resemblance with parents
   a) i and ii b) ii and iii
   **c) ii and iv** d) i and ii
3. A few statements with regard to sexual reproduction are given below:
   i. Sexual reproduction does not always require two individuals
   ii. Sexual reproduction generally involves gametic fusion
   iii. Meiosis never occurs during sexual reproduction
   iv. External fertilization is a rule during sexual reproduction
   Choose the correct statements from the options below:
   a) i and iv b) i and ii
   c) ii and iii **d) i and iv**
4. Given below are a few statements related to external fertilization. Choose the correct statements:
   i. The male and female gametes are formed and released simultaneously
   ii. Only a few gametes are released into the medium
   iii. Water is the medium in a majority of organisms exhibiting external fertilization
   iv. Offspring formed as a result of external fertilization have better chance of survival than those formed inside the organism
   a) iii and iv **b) i and iii**
   c) ii and iv d) i and iv
5. Which of the following statements, support the view that elaborate sexual reproductive process develops much later in the organic evolution?
   i) Lower groups of organisms have simpler body design
   ii)Asexual reproduction is common in lower groups
   iii)Asexual reproduction is common in higher groups of organisms
   iv)The high incidence of sexual reproduction is in angiosperms and vertebrates.
   a) i, ii and iii b) i, iii and iv
   **c) i, ii, and iv** d) ii, iii and iv

## Chapter 2 - Human Reproduction

1. Select the incorrect statement. [NEET 2016, phase I]
   a) LH and FSH trigger ovulation in ovary
   **b) LH and FSH decrease gradually during the follicular phase**
   c) LH triggers secretion of androgens from the Leydig cells.
   d) FSH stimulates the sertoli cells which help in spermiogenesis
2. Identify the correct statement on 'inhibitin' [NEET 2016, phase I]
   **a) is produced by granulose cells in ovary and inhibits the secretion of FSH**
   b) is produced by granulose cells in ovary and inhibits the secretion of LH
   c) is produced by nurse cells in testes and inhibits the secretion of LH
   d) inhibits the secretion of LH, FSH and prolactin.
3. Several hormones like hCG, hPL, oestrogen and progesterone are produced by [NEET 2016, phase I ]
   a) ovary **b) placenta**
   c) fallopian tube d) pituitary
4. Match column I with column II and select the correct option using the codes given below [NEET 2016, phase I]

| Column I | Column II |
|---|---|
| A. Mons pubis | 1.Embryo formation |
| B. Antrum | 2. Sperm |
| C. Trophectoderm | 3. Female external genitalia |
| D. Nebenkem | 4. Graafian follicle |

   | | A | B | C | D |
   |---|---|---|---|---|
   | a) | 3 | 4 | 2 | 1 |
   | **b)** | **3** | **4** | **1** | **2** |
   | c) | 3 | 1 | 4 | 2 |
   | d) | 1 | 4 | 3 | 2 |

5. Which one of the following is not the function of placenta? (NEET, 2013)
   a) To facilitate supply of oxygen and nutrients to embryo
   b) To secrete oestrogen
   c) To facilitate the removal of carbondioxide and material from embryo
   **d) To secrete oxytocin during parturition**
6. The testes in human are situated outside the abdominal cavity inside a pouch called scrotum. The purpose served is for [AIPMT 2011]
   a) escaping any possible compression by the visceral organs.
   b) providing more space for the growth of epididymis.
   c) providing a secondary sexual feature for exhibiting the male sex
   **d) maintaining the scrotal temperature lower than internal body temperature**
7. Hormones secreted by placenta to maintain pregnancy are [NEET,2018]
   a) hCG, hPL, progesterone, estrogen
   **b) hCG, hPL, estrogen, relaxin, oxytocin**

c) hCG, hPL, progesterone, prolactin
d) hCG, progesterone, estrogen, glucocorticoids

8. Match and select the correct option [NEET, 2018]

| Column I | Column II |
|---|---|
| a. Proliferative phase | 1. Breakdown of endometrium lining |
| b. Secretory phase | 2. Follicular phase |
| c. Menstruation | 3. Luteal phase |

| | a | b | c |
|---|---|---|---|
| A) | 3 | 2 | 1 |
| **B)** | **2** | **3** | **1** |
| C) | 1 | 3 | 2 |
| D) | 3 | 1 | 2 |

## Chapter 3 - Reproductive Health

1. Which of the following is a hormone releasing Intrauterine Device (IUD)? [AIPMT 2014]
   a) Multiload 375 **b) LNG-20**
   c) Cervical cap d) Vault
2. Assisted reproductive technology, IVF involves the transfer of [AIPMT 2014]
   a) Ovum into the fallopian tube
   **b) Zygote into the fallopian tube**
   c) Zygote into the uterus
   d) Embryo with 16 blastomeres into the fallopian tube
3. In context of amniocentesis, which of the following statements is incorrect? [NEET-I, 2016]
   a) It is usually done when a woman is between 14-16 weeks pregnant
   b) It is used for prenatal sex determination
   c) It can be used for detection of Down syndrome
   **d) It can be used for detection of Cleft palate**
4. Which of the following approach does not give the defined action of contraceptive? [NEET-I, 2016]

| | |
|---|---|
| a) Barrier methods | Prevent fertilization |
| b) Intra uterine devices | Increases phagocytosis of sperms, suppresses sperm motility and fertilizing capacity of sperms |
| c) Hormonal contraceptives | Prevent retard entry of sperms, prevent ovulation and fertilization |
| **d) Vasectomy** | **Prevents spermatogenesis** |

## Chapter 4 - Principle of Inheritance and Variation

1. The fruit fly *Drosophila* melanogaster was found to be very suitable for experimental verification of chromosomal theory of inheritance by Morgan and his colleagues because [AIPMT MAINS 2010]
   a) It reproduces parthenogenetically
   b) A single mating produces two young flies
   c) Smaller female is easily recognizable from large male
   **d) It completes the life cycle in about two weeks**
2. Which one of the following cannot be explained on the basis of Mendel's Law of Dominance? [AIPMT PRE 2010]
   a) The discrete unit controlling a particular character is called a factor
   b) Out of one pair factors one is dominant and the other recessive
   **c) Alleles do not show any blending and both the characters recover as such in F2 generation**
   d) Factors occur in pairs
3. ABO blood groups in humans are controlled by the gene I. It has three alleles – IA, IB and i. Since there are three different alleles, six different genotypes are possible. How many phenotypes can occur? [AIPMT PRE 2010]
   a) Three b) One **c) Four** d) Two
4. Which one of the following symbols and its representation, used in human pedigree analysis is correct? [AIPMT PRE 2010]
   **a) □=○=Mating between relatives**
   b) ○=Unaffected male
   c) □=Unaffected female
   d) ◊=Male affected
5. Which one of the following conditions correctly describes the manner of determining the sex in the given example? [AIPMT PRE 2011]
   **a) XO type of sex chromosomes determine male sex in grasshopper**
   b) XO condition in humans as found in Turner syndrome, determines female sex
   c) Homozygous sex chromosomes(XX) produce male in Drosophila
   d) Homozygous sex chromosomes(ZZ) determine female sex in birds
6. A normal-visioned man whose father was blind, marries a woman whose father was also colour blind. They have their first child as a daughter. What are the chances that this child would be colour blind? [AIPMT PRE 2012]
   a) 100% **b) 0%** c) 25% d) 50%
7. Which of the following statements is not true of two genes that show 50 per cent recombination frequency [AIPMT 2013]
   a) The genes may be on different chromosomes
   **b) The genes are tightly linked**
   c) The genes show independent assortment
   d) If the genes are present on the same chromosome
8. A pleiotropic gene: [RE-AIPMT 2015]
   a) Is a gene evolved during Pliocene
   b) Controls a trait only in combination with another gene
   **c) Controls multiple traits in an individual**
   d) Is expressed only in primitive plants
9. A gene showing codominance has: [RE-AIPMT 2015]
   a) Alleles tightly linked on the same chromosome
   b) Alleles that are recessive to each other
   **c) Both alleles independently expressed in the heterozygote**
   d) One allele dominant on the other
10. Pick out the correct statements: [NEET-I, 2016]
    a) Haemophilia is a sex-linked recessive disease
    b) Down's syndrome is due to aneuploidy
    c) Phenylketonuria is an autosomal recessive gene disorder
    d) Sickle cell anaemia is an X-linked recessive gene disorder

a) A and D are correct b) B and D are correct
c) A,C and D are correct **d) A,B and C are correct**

**Chapter 5 - Molecular Genetics**

1. The association of histone H1 with a nucleosome indicates (NEET 2017)
   a) Transcription is occurring
   b) DNA replication is occurring
   **c) The DNA is condensed into chromatin fibre**
   d) The DNA double helix is exposed
2. Which of the following is not required for any of the techniques of DNA fingerprinting available at present? [NEET 2016]
   **a) Zinc finger analysis**
   b) Restriction enzymes
   c) DNA-DNA hybridization
   d) polymerase chain reaction
3. Satellite DNA is important because it [AIPMT 2015]
   a) codes for proteins needs in cell cycle
   **b) shows high degree of polymorphism in population and also the same degree of polymorphism in an individual, which is heritable from parents to children**
   c) Does not code for protein and is same in all members of the population.
   d) Codes for enzymes needed for DNA replication.
4. The diagram shows an important concept in the genetic implication of DNA. Fill in the blanks A to C. (NEET 2013)

   A B C

   DNA ----→mRNA ----------→protein -proposed by---
   a) A- trancscription, B- replication C-James Watson
   b) A- trancscription, B- trancscription, C-Erwin
   **c) A- trancscription, B- tranlation, C-Francis Crick**
   d) A- trancscription, B- extension, C-Rosalind Frankin
5. Select the two statements out of the four (I –IV) given below about lac operon. [AIPMT 2010]
   i. Glucose or galactose may bind with the repressor and inactive it.
   **ii. In the absence of lactose, the repressor binds with the operator region**
   iii. The z-gene codes for permease.
   **iv. This was elucidated by Francois Jacob and Jacques monod.**
   The correct statements are
   a) i and ii b) i and iii **c) ii and iv** d) i and ii
6. Which one of the following pairs of codons is correctly matched with their function or the single for the particular amino acid? [AIPMT 2008]
   a) GUU, GCU – Alanine
   **b) UAG, UGA – Stop codon**
   c) AUG, ACG - start/methionine
   d) UUA, UCA – Leucine
7. The Okazaki fragments in DNA chain growth (AIPMT 2007)
   **a) Result in transcription**
   b) Polymerise in the 3' to 5' direction and forms replication fork
   c) Prove semi- conservative nature of DNA replication
   d) Polymerises in the 5' to 3'direction and explain 3' to 5' DNA replication
8. During translation initiation in prokaryotes, a GTP molecules is needed in [AIPMT 2003]
   **a) association of 30s, mRNA with formyl met tRNA**
   b) association of 50s subunit of ribosome with initiation complex
   c) formation of formyl met tRNA
   d) binding of 30s subunit of ribosome with mRNA.
9. Reverse transcriptase is
   a) RNA dependent RNA polymerase
   b) DNA dependent RNA polymerase
   c) DNA dependent DNA polymerase
   **d) RNA dependent DNA polymerase**
10. *Escherichia coli* fully labeled with N14 medium. The two strands of DNA molecules of the first generation bacteria have
    a) Different density and do not resemble parent DNA
    **b) Different density but resemble parent DNA**
    c) Same density and resemble parent DNA
    d) Same density but do not resemble parents DNA

**Chapter 6 - Evolution**

1. The wings of a bird and of an insect are
   a) homologous structure and represent convergent evolution
   b) homologous structure and represent divergent evolution
   **c) analogous structure and represent convergent evolution**
   d) analogous structure and represent divergent evolution
2. Which one of the following statement is correct?
   a) stem cells are specialized cells
   a) there is no evidence of the existence of gills during embryogenesis of mammals
   b) all plant and animal cells are totipotent
   **c) Ontogeny repeats phylogeny**
3. In Hardy-Weinberg equation, the frequency of heterozygous individual is represented by
   a) P2 **b) 2pq** c) pq d) q2
4. The correct order in Era is
   a) Palaeozoic---- Archaeozoic --- Coenozoic
   b) Archaeozoic ---Palaeozoic------ Proterozoic
   **c) Palaeozoic--- Mesozoic ----- Coenozoic**
   d) Mesozoic ---- Archaeozoic---- Proterozoic
5. The most apparent change during the evolutionary history of *Homo sapiens* is raced in (AIPMT 2010)
   a) loss of body hair
   b) walking upright
   c) shortening of jaws
   **d) remarkable increase in the brain size.**
6. The process by which organisms with different evolutionary history evolve similar phenotypic adaptations in response to a common environmental challenge is called (AIPMT 2013)
   a) Natural selection
   **b) Convergent evolution**
   c) Non-random evolution
   d) Adaptive radiation Human health and diseases

**Chapter 7 & 8 - Human Health and Diseases and Immunology**

1. Select the correct statement from the given below. [AIPMT 2010]
   a) Barbiturates when given to criminals make them tell the truth
   **b) Morphine is often given to persons who have under gone surgery as a pain killer**
   c) Chewing tobacco lowers blood pressure and heart rate
   d) Cocaine is given to patients after surgery as it stimulates recovery
2. Match the following [AIPMT 2008]

| Column I | Column II |
|---|---|
| A) Amoebiasis | i) Treptonema pallidum |
| B) Diphtheria | ii) Use only sterilized food and water |
| C) Cholera | iii) DPT vaccine |
| D) Syphilis | iv) Use oral rehydration therapy |

| | A | B | C | D |
|---|---|---|---|---|
| a) | i | ii | iii | iv |
| b) | ii | iv | i | iii |
| c) | ii | I | iii | iv |
| **d)** | **ii** | **iii** | **iv** | **i** |

3. If a person shows production of interferons in his body, the chances are that he has got an infection of
   a) Typhoid **b) Measles**
   c) Tetanus d) Malaria
4. A person suffering from a disease caused by Plasmodium, experiences recurring chill and fever at the time when? [AIPMT MAINS 2010]
   a) The sporozoites released from RBC's are being rapidly killed and broken down inside spleen
   b) The trophozoites reach maximum growth and give out certain toxins.
   **c) The parasite after its rapid multiplication inside RBC's reptures them, releasing the stage to enter fresh RBC's**
   d) The microgametocytes and megagametocytes are being destroyed by the WBC's
5. Where will you look for the sporozoites of the material parasite? [AIPMT PRE 2011]
   a) Red blood corpuscles of humans suffering from malaria.
   b) Spleen of infected humans
   c) Salivary glands of freshy moulted female anopheles mosquito.
   **d) Saliva of infected female anopheles mosquito.**
6. Which one of the following organisms is scientifically and correctly named, correctly printed according to the International Rules of Nomenclature and correctly described? [AIPMT MAINS 2012]
   **a) Plasmodium falciparum – a protozoan causing the most serious type of malaria.**
   b) Felis tigris – The Indian tiger is well protected in Gir forests.
   c) E. Coli – The full name is Entamoeba coli, a commonly occurring bacterium in human intestine.
7. Which of the following endoparasites of humans does show vivipaity? [AIPMT 2015]
   a) *Ancylostoma duodenale*
   b) *Enterobius vermicularis*
   ***c) Trichimella spiralis***
   d) *Ascaris lumbricoides*
8. The active form of *Entamoeba histolytica* feeds upon: [AIPMT 2015]
   **a) Erythrocytes, mucosa and submucosa of colon**
   b) Mucosa and submucosa colon only
   c) Food in intestine
   d) Blood only
9. Which one of the following statements is correct with respect to AIDS? [AIPMT PRE 2010]
   a) The HIV can be transmitted through eating food together with an infected person.
   b) Drug addicts are least susceptible to HIV infection.
   c) AIDS patients are being fully cured 100 percent with proper care and nutrition.
   **d) The causative HIV retrovirus enters helper T-lymphocytes thus reducing their numbers.**
10. Select the correct statement with respect to diseases and immunization [AIPMT MAINS 2011]
    **a) If due to some reason B and T lymphocytes are damaged, the body will not produce antibodies against a pathogen**
    b)Injection of dead/inactivated pathogens caused passive immunity
    c) Certain protozoans have been used in mass production of hepatitis B vaccine.
    d) Injection of snake antivenom against snake bite is an example of active immunization.
11. Which one of the following statements is correct with respect to immunity? [AIPMT MAINS 2012]
    a) The antibodies against small pox pathogen are produced by T – lymphocytes
    b) Antibodies are protein molecules each of which has four light chains.
    c) Rejection of a kidney graft is the function of B – lymphocytes.
    **d) Preformed antibodies need to be injected to treat the bite by a viper snake.**
12. Which one of the following is not a property of cancerous cells whereas the remaining three are? [AIPMT PRE 2012]
    a) They compete with normal cells for vital nutrients
    b) They do not remain confined in the area of formation
    c) They divide in an uncontrolled manner
    **d) They show contact inhibition**
13. At which stager HIV infection does one usually show symptoms of AIDS? [AIPMT 2014]
    a) Within 15 days of sexual contact with an infected person
    b) When the infected retro virus enters host cells
    **c) When HIV damages large number of helper T-Lymphocytes**
    d) When the viral DNA is produced by reverse transcriptase
14. Match each disease with its correct type of vaccine [AIPMT 2015]

| | |
|---|---|
| a)Tuberculosis | i) harmless virus |
| b)Whooping cough | ii) inactivated toxin |
| c)Diphtheria | iii) killed bacteria |
| d)Polio | iv) harmless bacteria |

a) b) c) d)
a) (ii) (i) (iii) (iv)
b) (iii) (ii) (iv) (i)
**c) (iv) (iii) (ii) (i)**
d) (i) (ii) (iv) (iii)

15. Which of the following is correct regarding AIDS causative agent HIV? [NEET-II, 2016]
**a) HIV is enveloped virus that contains two identical molecules of single-stranded RNA and two molecules of reverse transcriptase**
b) HIV is unenveloped retrovirus
c) HIV does not escape but attacks the acquired immune response
d HIV is enveloped virus containing one molecule of single – stranded RNA and one molecule of reverse transcriptase

## Chapter 9 - Microbes in Human Welfare

1. When domestic sewage mixes with river water [AIPMT MAINS 2010]
a) Small animals like rat will die after drinking river water
b) The increased microbial activity releases micronutrients such as iron.
**c) The increased microbial activity uses up dissolved oxygen.**
d) The river water is still suitable for drinking as impurities are only about 0.1 per cent
2. Select the correct statement from the following. [AIPMT PRE 2010]
a) Biogas is produced by the activity of aerobic bacteria on animal waste.
b) Methanobacterium is an aerobic bacterium found in rumen of cattle.
c) Biogas, commonly called gober gas, is pure methane.
**d) Activated sludge-sediment in settlement tank of sewage treatment plant is a right source of aerobic bacteria.**
3. Read the following four statements (A to D): [AIPMT MAINS 2012]
a) Colostrums is recommended for the new born because it is rich in antigen.
b) Chikungunya is caused by a gram negative bacterium.
c) Tissue culture has proved useful in obtaining virus-free plants.
d) Beer is manufactured by distillation of fermented grape juice
How many of the above statements are wrong?
**a) Three** b) Four c) One d) Two
4. Which of the following are likely to be present in deep sea water? [AIPMT 2013]
a) Archaebacteria b) Eubacteria
c) Blue – green algae d) Saprophytic fungi
5. During sewage treatment, biogas are produced which includes [AIPMT 2015]
**a) Methane, hydrogen sulphide, carbon dioxide**
b) Methane, oxygen, hydrogen sulphide
c) Hydrogen sulphide, methane, sulphur dioxide
d) Hydrogen sulphide, nitrogen, methane
6. What gases are produced in anaerobic sludge digesters? [AIPMT 2014]
a) Methane and CO2 only
**b) Methane, hydrogen sulphide and CO2**
c) Methane, hydrogen sulphide and O2
d) Hydrogen sulphide and CO2
e) Consumption of organic matter in the water is higher by the microbes
7. Match the following list of microbes and their importance: [RE-AIPMT 2015]

| | |
|---|---|
| a)*Saccharomyces cerevisiae* | (i)Production of immunosuppressive agents |
| b)*Monasus purpureus* | (ii)Ripening of Swiss cheese |
| c)*Trichoderma polysporum* | (iii)Commercial production of ethanol |
| d)*Propionibacterium shermanii* | (iv)Production of blood-cholesterol lowering agents. |

e) (iv) (iii) (ii) (i)
f) (iv) (ii) (i) (iii)
g) (iii) (i) (iv) (ii)
**h) (iii) (iv) (i) (ii)**

8. Which of the following is wrongly matched in the given table? [NEET – I, 2016]

| Microbe | Product | Application |
|---|---|---|
| (a)*Trichoderma polysporum* | Cyclosporin A | Immunosuppressive drug |
| (b)*Monascus purpureus* | Statins | Lowering of blood cholesterol |
| (c) *Streptococcus* | Sterptockinase | Removal of clot from blood vessel |
| **(d)*Clostridium butylicum*** | **Lipase** | **Removal of oil stains** |

9. Match Column – I with Column – II and select the correct options using the codes given below: [NEET – II, 2016]

| Column I | Column II |
|---|---|
| A.Citric acid | 1. Trichoderma |
| B.Cyclosporin A | 2. Clostridium |
| C.Statins | 3. Aspergillus |
| D.Butyric acid | 4. Monoscus |

a) A:3, B:1, C:4, D:2
b) A:1, B:4, C:2, D:3
c) A:3, B:4, C:1, D:2
**d) A:3, B:1, C:2, D:4**

## Chapter 10 - Biotechnology and Its Application

1. Genetic engineering has been successfully used for producing [AIPMT RE 2010]
**a) Transgenic mice for testing safety of polio vaccine before used in humans.**

b) Transgenic models for studying new treatments for certain cardiac diseases.
c) Transgenic cow Rosie which produces high fat milk for making ghee.
d) Animals like bulls for farm work as they have super power.

2. Some of the characteristics of Bt cotton are [AIPMT RE 2010]
a) Long fibre and resistance to aphids
b) Medium yield, long fibre and resistance to beetle pests.
c) High yields and production of toxic protein crystals which kill dipteran pests.
**d) High yield and resistance to bollworms**

3. Bacillus thuringiensis forms protein crystals which contain insecticidal protein. This protein [AIPMT MAINS 2010]
**a) Binds with epithelia cells of midgut of the insect pest ultimately killing it.**
b) Is coded by several genes including the gene cry.
c) Is activated by acid pH of the foregut of the insect pest.
d) Does not kill the carrier bacterium which is itself resistant to this toxin.

4. Read the following four statements (A to D) about certain mistakes in two of them. [AIPMT MAINS 2011]
a) The first transgenic buffalo, Rosie produced milk which was human alpha – lactalbumin enriched.
b) Restriction enzymes are used in isolation of DNA from other macromolecules.
c) Downstream processing is one of the steps of rDNA technology
d) Disarmed pathogen vectors are also used in transfer of rDNA into the host.
Which of the two statements have mistakes?
a) B and C b) C and D
c) A and C **d) A and B**

5. The colonies of recombinant bacteria appear white in contrast to blue colonies of non-recombinant bacteria because of [AIPMT 2013]
**a) Non-recombinant bacteria containing β-galactosidase.**
b) Insertional inactivation of α-galactosidase in non-recombinant bacteria.
c) Insertional inactivation of α-galactosidase in recombinant bacteria.
d) Inactivation of glycosidase enzyme in recombinant bacteria

6. Which body of the Government of India regulates GM research and safety of introducing GM organism for public services? [AIPMT 2015]
a) Bio-safety committee
b) Indian council of agricultural research
**c) Genetic engineering approval committee**
d) Research committee on Genetic manipulation

7. In genetic engineering, a DNS segment (gene) of interest is transferred to the host cell through a vector. Consider the following four agents (A to D) in this regard and select correct option about which one or more of these can be used as vector/vectors. [AIPMT MAIN 2010]
A) A bacterium B) Plasmid
C) Plasmodium D) Bacteriophage
a) (A), (B) and (D) only b) (A) only
c) (A) and (C) only **d) (B) and (D) only**

8. Which one of the following palindromic base sequences in DNA can be easily cut at about the middle by some particular restriction enzyme? [AIPMT PRE 2010]
a) 5' – CGTTCG – 3' 3' –ATGGTA -5'
b) 5'-GATATG -3' 3' CTACTA -5'
**c) 5' –GAATTC – 3' 3' – CTTAAG-5'**
d) 5' –CACGTA -3' 3' –CTCAGT -5'

9. Restriction endonucleases are enzymes which [AIPMT PRE 2010]
**a) Make cuts at specific positions within the DNA molecule.**
b) Recognize a specific nucleotide sequence for binding of DNA ligase.
c) Restrict the action of the enzyme DNA polymerase.
d) Remove nucleotides from the ends of the DNA molecule.

10. Stirred – tank bioreactors have been designed for [AIPMT PRE 2010]
a) Addition of preservatives of the product
b) Purification of the product
c) Ensuring anaerobic conditions in the culture vessel
**d) Availability of oxygen throughout the process**

11. There is a retriction endonuclease called EcoRI. What does 'co' part in it stand for? [AIPMT PRE 2011]
a) Coelom b) Coenzyme
**c) Coli** d) Colon

12. Which one is true state regarding DNA polymerase used in PCR? [AIPMT PRE 2012]
a) It is used to ligate introduced DNA in recipient cells.
b) It serves as selectable marker
c) It is isolated from a virus.
**d) It remains active at high temperature.**

13. For transformation, micro-particles coated with DNA to be bombarded with gene gun are made up of [AIPMT PRE 2012]
a) Silver or Platinum b) Platinum or Zinc
c) Silicon or Platinum **d) Gold or Tungsten**

## Chapter 11 - Organisms and Population

1. Which one of the following is most appropriately defined? [AIPMT MAINS 2010]
a) Host is an organism which provides food to another organism.
b) Amensalism is a relationship in which one species is benefited whereas the other is unaffected.
**c) Predator is an organism that catches and kills other organism for food.**
d) Parasite is an organism which always lives inside the body of other organism and may kill it.

2. Study the four statements (1 to 4) given below and select the two correct ones out of them. [AIPMT PRE 2010]
a) A lion eating a deer and a sparrow feeding on grain are ecologically similar in being consumers.

b) Predator star fish Pisaster helps in maintaining species diversity of some invertebrates.
c) Predators ultimately lead to the extinction of prey species.
d) Production of chemicals such as nicotine, strychnine by the plants is metabolic disorders.
The two correct statements are
a) (B) and (C) b) (C) and (D)
c) (A) and (D) **d) (A) and (B)**

3. Which two of the following changes ( 1 to 4) usually tend to occur in the plain dwellers when they move to high altitudes(3500 m or more)? [AIPMT PRE 2010]
A) Increase in red blood cell size
B) Increase in red blood cell production
C) Increased breathing rate
D) Increase in thrombocyte count
a) (B) and (C) b) (C) and (D)
c) (A) and (D) **d) (A) and (B)**

4. Consider the following four conditions (A-D) and select the correct pair of them as adaptation to environment in desert lizards. [AIPMT PRE 2011]
The conditions:
A) Burrowing in soil to escape high temperature.
B) Losing heat rapidly from the body during high temperature
C) Bask in sun when temperature is low
D) Insulating body due to thick fatty dermis.
**a) (A) and (C)** b) (B) and (D)
c) (A) and (B) d) (C) and (D)

5. People who have migrated from the planes to an area adjoining Rohtang Pass about six months back [AIPMT PRE 2012]
**a)Have more RBC's and their haemoglobin has a lower binding affinity to O2.**
b) Are not physically fit to play games like football
c) Suffer from altitude sickness with symptoms like nausea, fatigue, etc.
d) Have the usual RBC count but then haemoglobin has very high binding affinity to O2.

6. A biologist studies the population of eats in a barn. He found that the average natality was 250, average mortality is 240, immigration is 20 and emigration to be 30. The net increase in population is [AIPMT 2013]
a) 10 b) 15 c) 05 **d) Zero**

7. An association of individuals of different species living in the same habitat and having functional interaction is: [RE-AIMPT 2015]
**a) Biotic community** b) Ecosystem
c) Population d) Ecological niche

8. Gause's principle of competitive exclusion states that: [NEET – I, 2016]
a) More abundant species will exclude the less abundant species through competition
b) Competition for the same resources excludes species having different food preferences
**c) No two species can occupy the same niche indefinitely for the same limiting resources**
d) Larger organisms exclude smaller ones through competition

9. When does the growth rate of a population following the logistic model equal zero? The logistic model is given as dN/dt=rN(1-N/K): [NEET – I, 2016]
**a) When N/K is exactly one**
b) When N nears the carrying capacity of the habitat
c) When N/K equals zero
d) When dearth rate is greater than birth rate

**Chapter 12 - biodiversity and conservation**

1. Select the correct statement about biodiversity [AIPMT MAINS 2012]
a) Large scale planting of Bt cotton has no adverse effect on biodiversity.
**b) Western Ghats have a very high degree of species richness and endemism**
c) Conservation of biodiversity is just a fad pursued by the developed countries.
d) The desert areas of Rajasthan and Gujarat have a very high level of desert animal species as well as numerous rare animals.

2. Sacred groves are specially useful in[AIPMT MAINS 2012]
**a) Preventing soil erosion**
b) Year-round flow of water in rivers
c) Conserving rare and threatened species
d) Generating environmental awareness

3. The highest number of species in the world is represented by [AIPMT PRE 2012]
**a) Fungi** b) Mosses c) Algae d) Lichens

4. Which of the following is not used for ex situ plant conservation? [AIPMT PRE 2012]
a) Field gene banks b) Seed banks
**c) Shifting cultivation** d) Botanical gardens

5. In which of the following both pairs have correct combination? [AIPMT 2015]
**a) In situ conservation: National Park**
**Ex situ conservation: Botanical Garden**
b) In situ conservation: Cryopreservation
Ex situ conservation: Wildlife Sanctuary
c) In situ conservation: Seed Bank
Ex situ conservation: National park
d) In situ conservation: Tissue culture
Ex situ conservation: Sacred groves

6. Cryopreservation of gametes of threatened species in viable and fertile condition can be referred to as [AIPMT 2015]
a) In situ conservation of biodiversity
**b) Advanced ex situ conservation of biodiversity**
c) In situ conservation by sacred groves
d) In situ cryo-conservation of biodiversity

7. The species confined to a particular region and not found elsewhere is termed as [RE-AIPMT 2015]
a) Alien **b) Endemic** c) Rare d) Keystone

8. Which of the following National Parks is home to the famous musk deer or hangal? [NEET-II, 2016]
a) Bandhavgarh National Park, Madhya Pradesh
b) Eaglenest Wildlife Sanctuary, Arunachal Pradesh

**c) Dachigam National Park, Jammu & Kashmir**
d) Keibul Lamjao National Park, Manipur

**Chapter 13 - Environmental Issues**

1. DB is a standard abbreviation used for the quantitative expression of [AIPMT PRE -2010]
a)The density of bacteria in a medium
**b) A particular pollutant**
c) The dominant bacillus in a culture
d) A certain pesticide

2. Which one of the following expanded forms of the following acronyms is correct? [AIPMT PRE-2011]

| | |
|---|---|
| a)UNEP | United Nations Environmental Policy |
| b)EPA | Environmental Pollution Agency |
| **c)IUCN** | **International Union for Conservation of Nature and Natural Resources** |
| d)IPCC | International Penal for climate Change |

3. In an area where DDT had been used extensively the population of birds declined significantly because [AIPMT PRE-2012]
a) Birds stopped laying eggs
b) Earthworms in the area got eradicated.
c) Cobras were feeding exclusively on birds.
**d) Many of the birds eggs, laid, did not hatch.**

4. Which one of the following is a wrong statement? AIPMT PRE-2012]
a) Most of the forests have been lost in tropical areas.
**b) Ozone in upper part of atmosphere is harmful to animals.**
c) Greenhouse effect is natural phenomenon
d) Eutrophication is a natural phenomenon in freshwater bodies.

5. Measuring Biochemical Oxygen Demand (BOD) is a method used for [AIPMT PRE-2012]
**a) Estimating the amount of organic matter in sewage water.**
b) Working out the efficiency of oil driven automobile engines.
c) Measuring the activity of *saccharomyces cerevisiae* in producing curd on a commercial scales
d) Working out the efficiency of RBCs about their capacity to carry oxygen

6. Kyoto Protocol was endorsed at [AIPMT -2013]
**a) CoP-3** b) CoP-5
c) CoP-6 d) CoP-4

7. A scrubber in the exhaust of a chemical industrial plant removes
a) Gases like sulphur dioxide.
**b) Particulate matter of the size 5 micrometer or above.**
c) Gases like ozone and methane
d) Particulate matter of the size 2.5 micrometer or less

8. Rachel Carson's famous book 'Silent Spring' is related to [AIPMT-2015]
**a) Pesticide pollution**
b) Noise Pollution
c) Population explosion
d) Ecosystem management

9. Which of the following is not one of the primary health risks associated with greater UV radiation through the atmosphere due to depletion of stratospheric ozone? [AIPMT-2015]
a) Increased skin cancer
b) Reduced immune system
c) Damage to eyes
**d) Increased liver cancer**

10. Increase in the concentration of the toxicant at successive trophic levels is known as [RE AIPMT-2015]
a) Biodeterioration
b) Biotransformation
c) Biogeochemical cycling
**d) Biomagnifications**

11. A river with an inflow of domestic sewage rich in organic waste may result in: [NEET-I, 2016]
a) Drying of the river very soon due to algal bloom
b) Increased population of aquatic food web organisms
c) An increased production of fish due to biodegradable nutrients
**d) Death of fish due to lack of oxygen**

12. A lake which is rich in organic waste may result in [NEET-II, 2016]
a) Drying of the lake due to algal bloom
b) Increased population of fish due to lots of nutrients
**c) Mortality of fish due to lack of oxygen**
d) Increases population of aquatic organisms due to minerals

13. The highest DDT concentration in aquatic food chain shall occur in [NEET-II, 2016]
**a) Seagull** b) Crab
c) Cell d) Phytoplankton

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