



OUR ENVIRONMENT

INTRODUCTION

The physical and biological world we-live in is called our **environment**. It has the following three important parts:

1. Living organisms
 2. Physical surroundings
 3. Meteorological factors (or climatic factors).
- The living organisms which constitute environment are plants; animals, human beings and micro-organisms.
 - The physical surroundings, which make up the environment, are land, water bodies and air.
 - The meteorological factor or climatic factors, which form a part of our environment, are sunlight, temperature, rainfall, humidity,

In this chapter we are going to learn about interaction of various factors of the environment and effect of human activities affecting environment and various biogeochemical cycles.

	ON YOUR TIPS	
Ecology is the study of inter relationships of organisms between the biotic and abiotic components of their environment. The 'Ecology' term was coined by Ernst Haeckel (1868).		

ENVIRONMENTAL PROBLEMS

Effect of human activity is an important factor which causes difference in the environment of different places. Through overuse, misuse and mismanagement of natural resources to fulfil his needs, man has done great damage to the environment himself. Various environment problems have arisen as a result of pollution, increasing population and coming up of advanced science and technology.

There is crowding, very less number of trees, large number of factories, which emit black smoke and large number of motor vehicles which emit poisonous gases. Moreover, due to large population there is lot of garbage, which is thrown indiscriminately on roads and other common places, also to meet the demands of increasing population lot of trees are being cut. These uncontrolled human activities not only pollute the city environment like soil, air and water but also harm the living organisms that are so essential for our survival. All these activities lead to ecological imbalance.



POLLUTION AND POLLUTANTS

With the increase in human population and advancement in technology waste materials have multiplied in quantity. Contamination of environment with this waste material is called pollution. Not only the wastes but certain useful materials like fertilizers may also contaminate the environment. Thus, pollution may be defined as a change in the physical, chemical or biological aspects of environment which make it harmful for living organisms.

Materials or agents which cause pollution of the environment are termed as pollutants e.g., smoke from vehicles, industries, sewage, various radioactive substances.



Pollutants are categorized into two types based on degradability

(a) Biodegradable pollutants

(b) Non-biodegradable pollutants

Biodegradable pollutants can be quickly degraded by natural means i.e., by the action of various micro-organisms e.g., sewage, paper, wool, bones and wood.

Non-biodegradable pollutants are either not degraded or degraded very slowly. They are not easily broken down e.g., DDT, plastics, radioactive wastes, silver foil, aluminium cans, glass and plastics. These pollutants may accumulate in large concentration as they pass through various food chains (biomagnification). Pollution can be of different types-Air, Water, Land, Noise.

ADDITION OF WASTES TO THE ENVIRONMENT

ACTIVITY 3.1

To prove that some domestic waste materials change their form and structure over time while others remain unchanged over long periods.



Procedure

1. Collect all kinds of waste materials from your home. These waste materials will mainly include:
 - kitchen wastes like vegetable and fruit peels, spoilt food, used tea leaves, milk packets and empty cartons
 - paper
 - empty medicine strips and bottles
 - old torn clothes
 - plastic bottles
 - broken footwear
 - Polythenes.
2. Dig a pit at home or in the school.
3. Put all waste material in a pit.
4. Cover the pit with soil and keep it wet.
5. Observe after 15 days.

Conclusion

Few materials **change** their shape and structure over period of time and are called as **biodegradable materials** while others remain **unchanged** are non-biodegradable. Few biodegradable materials change fast while others take longer time.

From above experiment, it is clear that some of the junk is readily degradable by the activity of micro-organisms in nature and materials are recycled but some are not easily degraded like polythene, plastics etc.

	ON YOUR TIPS	
On the basis of size, ecosystem may be classified as : (1) Small ecosystem (flowerpot, water in a dish). (2) Large ecosystem (forest, desert, ocean).		

• BIODEGRADABLE AND NON-BIODEGRADABLE MATERIALS

Different waste materials produced by various activities of man can be broadly classified into two categories:

1. Biodegradable wastes
2. Non-biodegradable wastes.

BIODEGRADABLE WASTES

- Biodegradable wastes materials are those waste materials which can be broken down into simpler, non-poisonous substances by the action of micro-organisms.
- As we know various enzymes are required to digest or hydrolyse or break food into simpler forms. These enzymes are specific in action and act only on a specific material. That is why various man-made materials like plastic cannot be degraded by action of bacteria or saprophytes. They can be changed only by physical processes like heat and pressure.
- Some examples of biodegradable wastes are cattle dung, paper, wool, wood, bones, leather, plant products such as wheat, maize, etc.
- Many industries also produce biodegradable wastes. All biodegradable wastes should be treated properly before discharging them into soil or water.

Any industrial unit, which dumps untreated wastes into soil or water, should be severely punished.

Recycling of Biodegradable Waste Materials: Sometimes biodegradable wastes are recycled. In the recycling process, the nutrients withdrawn from various nutrient pools are returned back. Use of cattle dung for the manufacture of Gobar gas and use of waste vegetable matter for preparing compost are two examples of recycling of biodegradable wastes.

Recycling of waste materials helps in maintaining ecological balance: Because during this process various nutrients present in the waste are returned to the natural pools from where they were initially withdrawn. For example, plants draw various nutrients from soil for their growth.

When the plants die, they change into waste, which can be converted into compost by the action of bacteria. When compost is added to the soil as manure the various nutrients are returned back to it. Thus, recycling of waste materials helps in maintaining ecological balance. If the various nutrients are continuously drawn from the soil but are not returned, it may create an imbalance in nature.

NON-BIODEGRADABLE WASTES

The waste materials, which cannot be broken down into simpler substances easily in nature, are known as non-biodegradable wastes. Aluminium cans, silver foil, iron nails, plastics, glass, DDT and radioactive wastes are some examples of non-biodegradable wastes. These non-biodegradable wastes are major pollutants of the environment.

Radioactive waste materials are one of the non-biodegradable wastes, which can pollute the earth to dangerous levels of toxicity. These wastes are produced in nuclear reactors, laboratories and hospitals, which use radioactive substances. These radioactive wastes release high-energy particles, which are extremely harmful to all living forms, both animals (including man) and plants.

Pollution caused by nuclear wastes assumes a universal dimension because the particles emitted by radioactive wastes spread far and wide in a short period and hence affect the populations, which are quite

away from the source of pollution. Thus, pollution due to nuclear wastes is not a problem of a country but is a problem of the whole world.

To conclude, we can say that recycling of waste materials helps in maintaining the ecological balance in the following ways:

1. Recycling of biodegradable wastes such as biomass helps in returning the various nutrients to the soil.
2. Recycling of non-biodegradable wastes reduces the problem of pollution because disposal of these wastes causes pollution.
3. As a result of recycling of waste materials new resources are not used. For example recycling of paper reduces the cutting of trees for the manufacture of paper.
4. Recycling reduces the volume of wastes.
5. Recycling is better than incineration as it prevents pollution.



• ECOSYSTEM AND ITS COMPONENTS

No organism or a species lives alone, always there are associations influencing each other and organising themselves into communities. The organisms of any community besides interacting among themselves, always have functional relationship with the environment. This structural and functional system of communities and their environment is called an **ecosystem**.

Two main components of ecosystem are: Biotic (living) and Abiotic (Non-living).

BIOTIC COMPONENTS

Includes autotrophs and heterotrophs (consumers and decomposers).



Classification of Living Organisms

Living organisms are mainly classified as producers, consumers and decomposers.

- (1) **Producers** include plants and some blue green algae which can make their own food in the form of organic compounds like sugar and starch by the process of photosynthesis. They are also called autotrophs.
- (2) **Consumers** depend on producers directly or indirectly. **Herbivores** directly eating plants are called **primary consumers** while **carnivores** consuming herbivores are **secondary consumers**. Both producers and consumers have their life cycles and new generation of population develop while old ones die. If the materials so locked in the body of the organism are not returned to soil and atmosphere, the cycling of materials will stop and earth will be full of dead organisms. There is continuous, breaking up or decomposition of organic materials everywhere in all ecosystems. This role is played by **decomposers**.
- (3) **Decomposers**. Some organisms with a specialized mode of nutrition and life like bacteria, fungi constantly decompose dead organic materials into simple inorganic substances and during the process

derive from them their food and energy. These are called **decomposers** or **reducers**. You can understand role of decomposers by not cleaning aquarium.

- (4) **Parasites**. Some of the consumers live on or in other organisms and derive their nourishment from host's body. They are known as **parasites** e.g., Tape worm, leech.

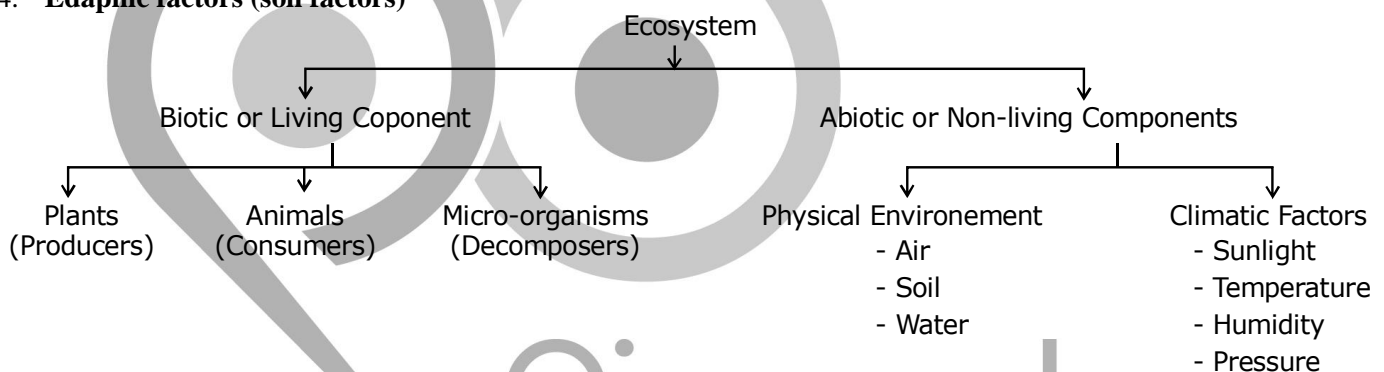
	ON YOUR TIPS	
Parasites are the organisms live on or inside the body of other organisms to obtain their food e.g.-Escherichia coli (bacteria), tapeworm.		

ABIOTIC COMPONENTS

Include materials and energy. Materials are like water, mineral salts, atmosphere gases etc. and energy is like light, heat, stored energy in chemical bonds etc.

Abiotic part is divided into 3 components:

1. **Inorganic substances** like carbon, nitrogen etc.
2. **Organic compounds** like carbohydrates, proteins, fats etc.
3. **Climate** like temperature, light, pressure etc.
4. **Edaphic factors (soil factors)**



- The **materials** continuously keep on cycling i.e., entering into the living system and through death and decay returning to soil and atmosphere. This process is called **mineral circulation** or the bio-geochemical cycles.
- While materials keep on cycling, fresh **energy** is continuously trapped from the sun by green plants on one hand and lost in space through respiration by all types of organisms.

TYPES OF ECOSYSTEMS

- **Terrestrial ecosystem** are named after the type of organism and habitat conditions, such as grassland ecosystem, crop ecosystem, forest ecosystem and desert ecosystem.
- **Fresh water ecosystems** are usually named upon the size and nature of freshwater body, such as river ecosystem, pond ecosystem, Lake Ecosystem.
- **Marine ecosystem** is the largest and most uniform aquatic ecosystem.

Some of the ecosystems are man-made and are called **artificial ecosystem**. e.g., garden, aquarium etc. Ecosystem is a functional system which in balanced condition is self-sufficient and self-regulated. But at the same time, several ecosystems are interrelated and combine to form larger ecosystem. e.g., the tree ecosystem in association with have variety of other trees, smaller plants and animals form forest ecosystem.



A Little further 3.2

Why decomposers are known as cleaners of the environment?

Explanation

Due to the presence of decomposers the various nutrient elements which were initially taken by plants from the soil, air and water are returned to the soil, air and water after the death of plants and animals thus decomposer organisms help in recycling the materials

• FOOD CHAIN

- (1) The series of organisms fixing energy, eating and being eaten is called a **food chain**.
- (2) Each step of a food chain is called a **trophic level**.
- (3) **First trophic level** always consists of autotrophs which can fix solar energy.
- (4) **Second trophic level** is that of herbivores feeding on autotrophs constituting primary consumers.
- (5) **Third trophic level** includes secondary consumers feeding on herbivores.
- (6) **Fourth trophic level** includes tertiary consumers which feed on secondary consumers.

Food chain can be traced in any ecosystem e.g., Food chain in a grassland

Grass → Grasshopper → Frog → Snake → Vulture.

Food chain in a forest

Plants → Deer → Lion.

Food chain in a pond

Phytoplankton → Zoo planktons → small fish → big fish.

- (7) The food chain starting from the green plants through herbivores to top carnivore is called **grazing food chain**.
- (8) Food chain starting from the dead organic matter being consumed by detritus feeding micro-organisms which in turn are eaten by some other predators is called **detritus food chain**.

In order to understand how an imbalance is created due to disruption of food chains by man's activities, let us consider the food chain

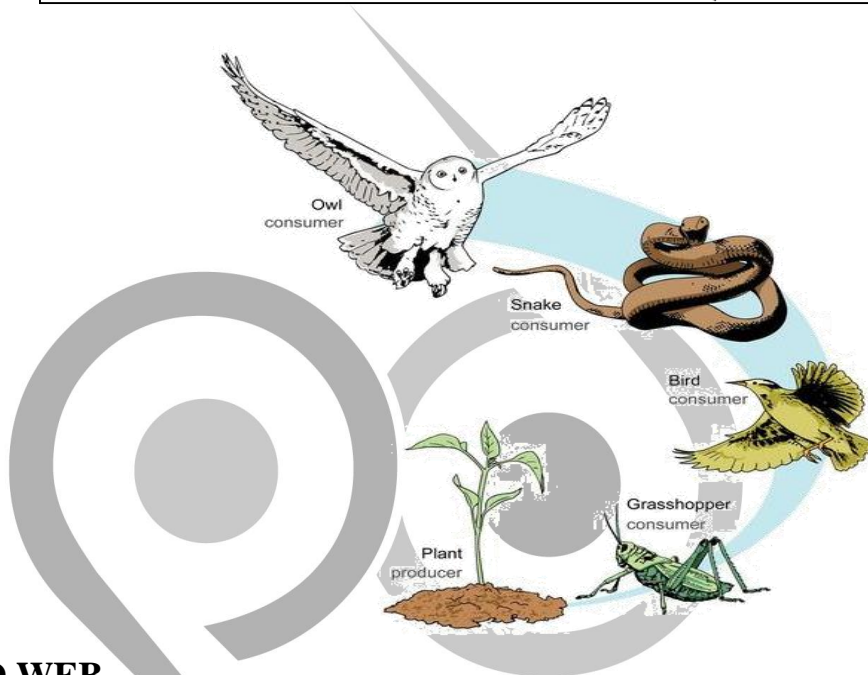
Grasses → Deer's → Lions.

1. In the above food chain, **if all the lions are removed**, the population of deer will increase since there won't be any lions to kill them and keep the population under control. This will lead to high consumption of grasses (producers) and may even eliminate them.
2. **If the deer population is removed** instead of lions, it will lead to decrease of lion population since there will not be any prey. The lions may even resort to other preys such as domestic animals or man to survive.

If the deer and lion operate in other food chains in a food web, then the removal of any of them will lead to disruption of the food web and will cause disturbance in the ecosystem

3. **If the grasses (producers) are removed**, then all life will come to an end. If there is no there will be no herbivores. If there are no herbivores, there will be no carnivores, ultimately all organisms will die.

A Little further 3.3
In comparing the two ecosystems 'A' and 'B' it is obtained that 'A' has only first and second order consumers, while 'B' has third, fourth and fifth order consumers.
Which of the two would be more stable ?
Explanation
A' will be more stable because it has lesser number of trophic levels.



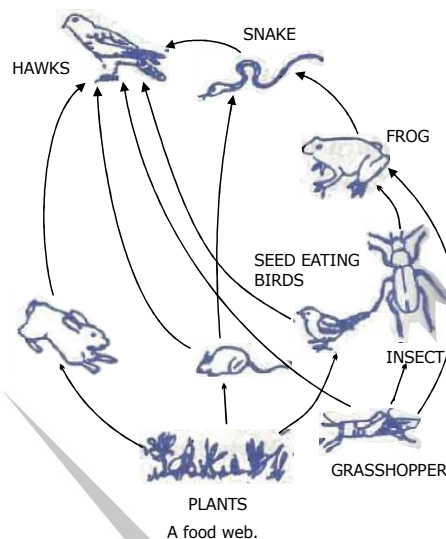
• FOOD WEB

1. The food relations are not always simple chain like but forms complicated network. The net like trophic interrelationship is called a **food web**.
2. In a food web, one organism may be linked with several others in an interlocking food linked into a network.
3. In all ecosystems not only the different grazing food chains get interlocked, but the detritus chain also gets interconnected.
4. At each trophic level some energy is used for itself, some passes to the next trophic organisms as food and some is routed to the detritus food chain by way of excretion.

Food chains do not operate in isolation i.e., various food chains are interconnected to each other forming a complex network. For example, food chains in a grassland, a forest, a crop field or a pond form a network with intercrossed and linkages. Grass may be consumed by rabbit which is in turn consumed by hawks. The grass is also consumed by insects which in turn are consumed by frogs. Frogs are consumed by snakes and snakes by hawks.

The network formed by various food chains which are interconnected with each other is called a **food-web**.

A particular organism may occupy position in more than one food chains. For example, in the food web shown above, mice are present in two food chains. These chains are:



Plants → Mice → Snakes → Hawks

Plants → Mice → Hawks

In the first food chain mice are consumed by snakes whereas in the second food chain they are consumed by hawks.

Other food chains operating in this food web are:

Plants → Grasshopper → Frogs → Snakes → Hawks

Plants → Grasshopper → Insects → Frogs → Snakes → Hawks

Plants → Rabbits → Hawks

Plants → Seed eating birds' → Hawks.

• THE FLOW OF ENERGY IN AN ECOSYSTEM

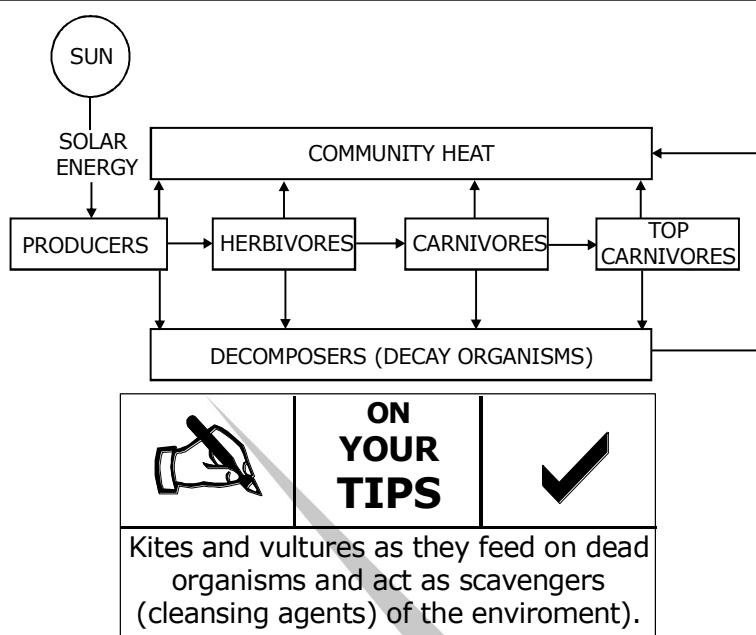
In a food chain, food which provides energy is transferred stepwise from one trophic level to another. Thus, energy is used and conveyed from one trophic level to another. This process is called '**flow of energy**'. It is a one way process and energy once used by the food chain of an ecosystem is lost forever.

The initial level where energy from the environment enters the living components is at the producer level. Green plants trap solar energy from the sun and utilize it for photosynthesis. Plants are able to trap the sun's energy due to the presence of green pigment, **chlorophyll**, present in them. This process converts solar energy into chemical energy which is stored as carbohydrates.

About 1% of the total sun's energy that reaches earth is used up in photosynthesis.

The chemical energy stored in plants is used up in their respiration growth (tissue building) and repair. Some of the energy is not utilized and is released into the community environment.

Plants are consumed by herbivores (First order consumers). The chemical energy stored in the plants as carbohydrates is consumed by herbivores as food. A portion of this energy is used for metabolic activities and growth of the herbivores. Some of the energy is not utilized and is released by these animals as heat into the environment.



The herbivores are consumed by carnivores (Second order consumers) and the same process is repeated as in herbivores and unutilized energy is released into the environment by these animals as heat. The amount of energy which is released as heat into the environment is taken to be lost.

It may be noted that a part of the energy at each trophic level is transferred to the decomposers or decay organisms. The decomposers utilize a part of this energy for maintaining their life processes. The unutilized energy is released as heat into the environment.

From above discussion we conclude:

The main points related to flow of energy in the ecosystem can be summarised as –

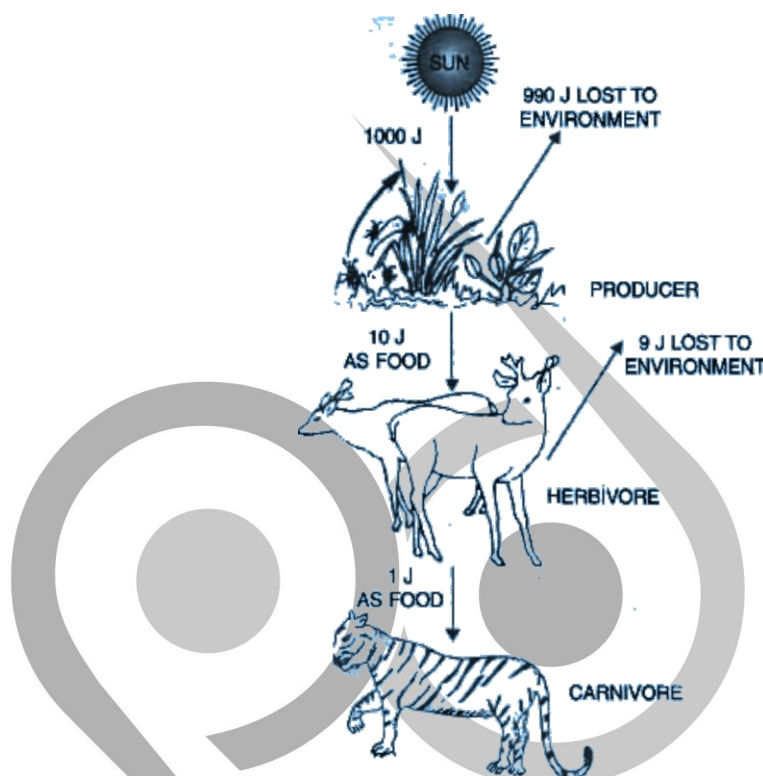
- (i) Energy is never created. Energy is always converted from one form to the other in an ecosystem. The light energy from the sun is converted into the chemical energy through photosynthesis.
- (ii) The energy flow is irreversible. There occurs a continuous transfer of energy from one trophic level to the next in a food chain.
- (iii) The amount of energy flow decreases with successive trophic levels.
- (iv) At every trophic level, some energy is utilised by the organisms for various metabolic activities like respiration, growth and reproduction.
- (v) Some energy is lost at each trophic level as heat and remains unutilised. So, we can conclude that when we move from the first trophic level and to third trophic level, the amount of energy gradually decreases.
- (vi) One percent of solar energy is trapped by green plants and is converted into food energy by the process of photosynthesis.

Other Points Related to Energy Flow

- (1) Part of the chemical energy in plant tissues is passed from organism to organism as they are successively eaten.
- (2) Ultimately the entire energy trapped by green plants at one time is lost from the ecosystem in several stages.
- (3) 10% energy is passed from one trophic level to another. e.g., when green plants are eaten by herbivores then only 10% of the energy available with plants is passed to them.
- (4) Most of the heat i.e., 80% is lost as heat to the environment and some is used to carry out various metabolic activities like digestion, growth, reproduction etc., and doing work.
- (5) Energy therefore does not move in a free condition, but rather through organic materials from one trophic level to another.

- (6) One important concept of ecological energetics is that energy always flows in one direction in the ecosystem while materials like carbon, nitrogen, hydrogen, oxygen etc. are repeatedly used in the ecosystem cycling from inorganic to organic and back to inorganic forms.
- (7) Since very small amount of energy is passed to the next trophic level, food chains consist of three to four steps. After this, energy left is not enough to survive.

- **Ten Percent Law**



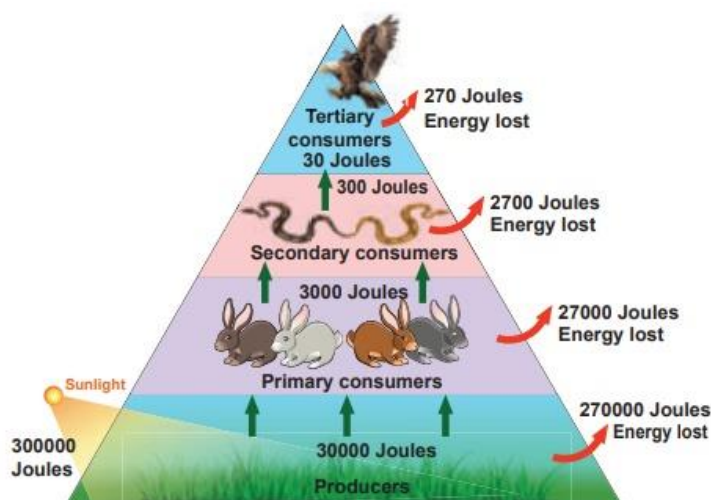
Studies of various food chains show that **the energy available at each successive level is 10% of the previous level.** This is called the **10 per cent law**. In the given illustration, 1000 J of energy is available to the plants from the sun. Plants convert 1 per cent of this energy into chemical energy. Thus, 10 J of energy is stored in plants. This energy is available to herbivores. Herbivores retain 10 per cent of 10 J i.e., 1 J as stored energy and 9 J of energy would be lost to the environment. Thus, only 1 J of energy would be available to carnivore as food.

The flow of energy in the living components of the biosphere is unidirectional. The energy enters the living components from non-living environment through photosynthesis. The radiant energy of sun converted into chemical energy is never converted back into radiant energy but is dissipated into the atmosphere as heat at every step. In food chain, a large amount of energy remains unutilized and is lost to the environment as heat at each trophic level. The energy lost as heat to the environment cannot be reutilized by plants for photosynthesis.

Energy transfers in the biosphere in food chains obey the laws of thermodynamics.

- **The first law of thermodynamics** says that energy can be converted from one form to another but can never be created or destroyed. In a food chain it is observed that energy is converted from one form to another. It is frequently transformed into heat energy which is unusable and is released into the environment. But the energy itself is not destroyed.
- According to the **second law of thermodynamics** energy transformation is never completely efficient. Whenever energy is transformed from one form to another, there is a decrease in the amount of useful energy; a part of energy is converted into heat. Thus, energy transformation in the biosphere among living organisms obeys the laws of thermodynamics.
- Ten percent Law was given by Lindeman in the year 1942. According to this law, during transfer of energy from one trophic level to another, only about 10% energy is available for transfer to next trophic level while remaining 90% is lost in respiration, digestion and transfer.

Thus, transfer of energy from was one trophic level to another is never 100%. It is actually 10% of energy of the previous level which is available for the next trophic level.



Vegetarian food habits can provide more energy: It can be observed that with successive trophic levels, there is decrease in the amount of energy available. Hence, if we are closer to the producer level, we can get more energy (calories) from the food because at the producer level, the amount of energy available is the highest. Consider the two food chains involving man as given below:

Producers (Plants) → Goat → Man

Producers (Plants) → Man

In the second food chain, man is closer to producer level and hence he gets more energy. On the other hand in the first food chain involving three steps man is away from the producer level and hence gets less energy. As an illustration, let us consider a case in which plants receive 1000 J of energy from the sun. Plants convert 1% of the solar energy into food. Thus, 10 J of energy would be stored in plants as food. Now, if the man is vegetarian then he would get 10 J of energy by eating plants.

Plants → Man

However, if the man is non-vegetarian, he would receive only 1 J of energy by eating meat in a three step food chain

Plants → Goat → Man

Here goat receives 10 J of energy and transfers 10% to man. Thus, a non-vegetarian man receives only 1 J of energy. From this we conclude that vegetarian food habits provide more energy than non-vegetarians.

• ECOLOGICAL PYRAMIDS

Food chains involving various living organisms in a community can also be represented in a graphical manner by drawing pyramids called ecological pyramids.

An ecological pyramid is a graphical representation of a specific parameter (such as number, biomass or energy) of a food chain.

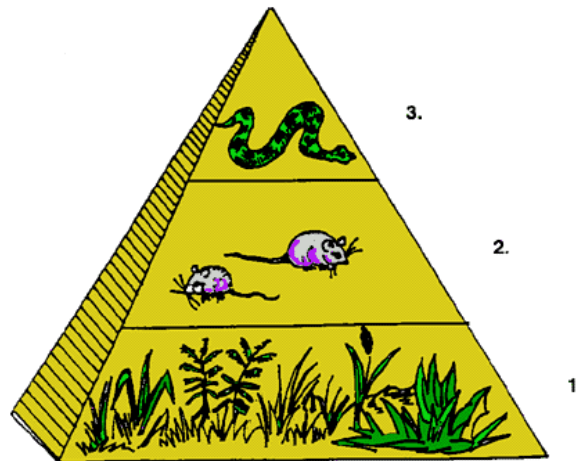
Ecological pyramids have various levels. The producer level is represented by the base of the pyramid. And as the trophic levels increase the pyramid goes on tapering upwards. The carnivores are on top of the pyramid.

Ecological pyramids can be of various types-pyramid of number, pyramid of biomass, pyramid of energy. Pyramid of number is constructed on the basis of the number of organisms at each level. Pyramid of Biomass is constructed on the basis of biomass of all the organisms at each trophic level. Pyramid of energy is constituted on the basis of the energy contained in all the organisms at each trophic level.

PYRAMID OF NUMBERS

Pyramid of numbers is constructed on the basis of the number of organisms at each trophic level in the food chain. In a food chain, the number of animals decreases at successive trophic levels. At the bottom of the pyramid are the green plants which synthesize food through photosynthesis, using sun's energy. Just above the plants are herbivores. The animals at the lowest level of the pyramid are large in number. At the successive higher levels of the pyramid, the number of

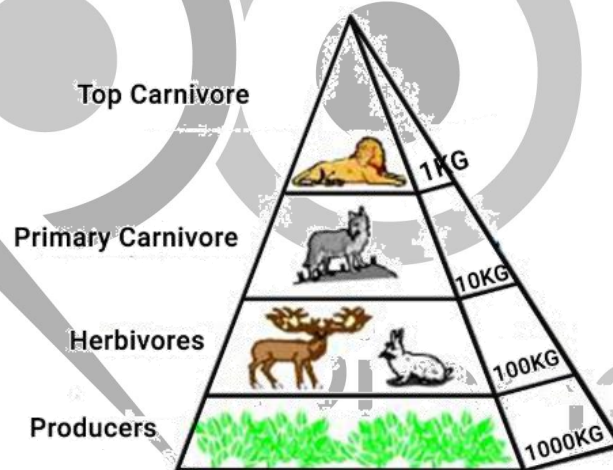
animals decreases. The top carnivores at the top of the pyramid are very few. For example, in a forest there may be large number of deers but there will be only a few lions.



PYRAMID OF BIOMASS

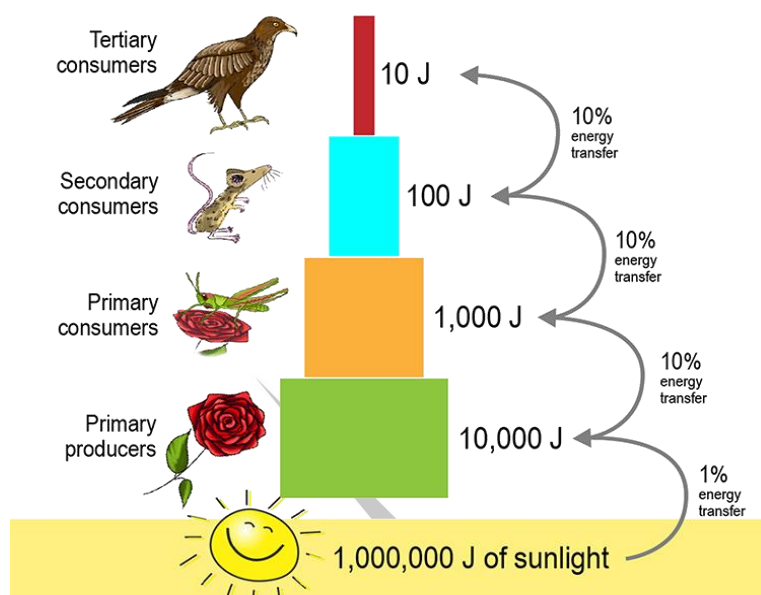
Biomass means the amount of living matter. **The pyramid of mass is constructed on the basis of mass of all organisms in each trophic level in the food chain.** The total biomass of the plants is greater than that of the herbivores. The total biomass is greater than that of first order carnivores.

In a food chain only 10 per cent of the biomass is transferred from one trophic level to the next level in the food chain as illustrated



PYRAMID OF ENERGY

The pyramid of energy is constructed on the basis of total energy contained in all the organisms of each trophic level of the food chain. As discussed earlier, the amount of usable energy decreases at each trophic level in a food chain because at each step some energy is lost as heat to environment. Plants have the maximum store of chemical energy. Herbivores have less energy which is only about 10 per cent of the energy stored in plants. **Only 10 per cent of the chemical energy of previous level is retained by the next trophic level.** This is called **10 per cent law**. As an illustration let us assume that 10 J of energy is stored in plants. Herbivores feeding upon them would retain 1 J (10% of 10 J) of energy. Carnivores feeding on herbivores would gain 0.1 J (10% of 1 J) of usable energy. This is illustrated this pyramid is always upright.

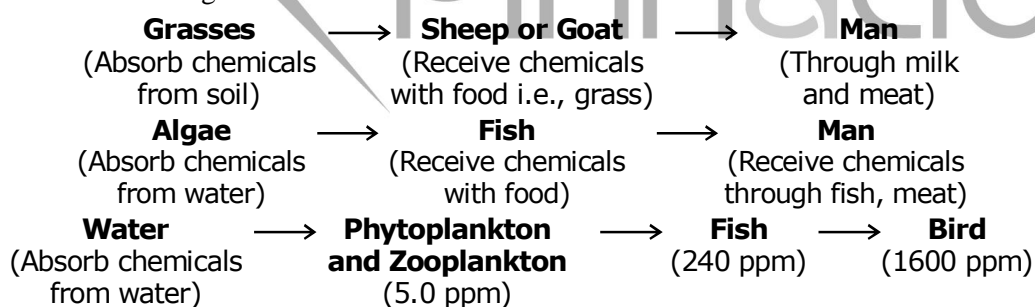


• BIOMAGNIFICATION

Bio-magnification is another aspect of food chain in which harmful chemicals enter food chains and are passed from one trophic level to another getting concentrated at each level.

ACCUMULATION OF HARMFUL CHEMICALS IN FOOD CHAINS

It is seen that through the food chain some harmful chemicals enter our bodies. We know that pesticides and insecticides are used to protect crops from diseases and pests. These chemicals enter the soil and gradually either enter the water table or get absorbed by plants along with water and mineral salts. Thus, they enter the food chain at the producer level. At each trophic level these harmful chemicals get more and more concentrated and ultimately reach our bodies. It has been shown by studies that humans have higher concentration of these chemicals than organisms lower in the food chain. For example, DDT which is used against mosquitoes is present in the highest concentration in human beings. Thus, we can conclude that an organism which is on the extreme upper level of the food chain, has the maximum concentration of the harmful chemicals in its body. This phenomenon is known as biomagnification or biological magnification. The following example illustrates the phenomenon of bio magnification.



The process of concentration of harmful chemicals such as pesticides, at each successive step in a food chain is called **biological magnification**.

Man being an omnivorous, eats fish, meat as well as vegetables. Being a powerful and intelligent animal, he is very rarely eaten by any animal. Thus, he is at the top of most food chains. In other words, he is only a consumer. **As a result of pollution, there are greater chances of accumulation of harmful chemicals in his body, which can be very harmful.**

Accumulation of Metallic effluent like mercury and fluorine are very harmful for human health. Mercury can lead to disease namely Minamata and fluorine can lead to knee-knock syndrome i.e., bending of legs. Fluorine may also cause fluorosis.

➤ **Methods to reduce intake of pesticides**

- Use of manures rather than fertilizers.
- Minimum use of chemicals like pesticides etc.
- Instead biological method should be used to control insects and pests.
- Disease resistant varieties of crops should be developed by using hybridisation technique.
- Domestic and Industrial wastes should not be disposed in lakes and rivers.
- Wash fruits and vegetables before their consumption.

• **EFFECT OF HUMAN ACTIVITIES ON ENVIRONMENT**



Some of the activities of man have disturbed the environment:

1. Deforestation
 - For getting wood for fuel and furniture.
 - For developing fields for cultivation.
 - For developing urban areas.
2. Mining to get various minerals, coal and petroleum.
3. Use of large number of vehicles for transportation.
4. Generation of electricity through
 - Thermal power plants.
 - Hydroelectric power plants.
 - Nuclear power plants.
5. Construction of roads, railway tracks etc.
6. Development of many harmful products such as plastics.
7. Extensive use of pesticides and other chemicals.
8. Use of chlorofluorocarbons.

Various human activities change the environment and affect us. In this chapter we are going to discuss two major environmental problems i.e.

(a) Ozone layer depletion.

(b) Waste disposal.

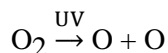
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<p>The use of a lot of clay for making millions of kulhads daily led to the loss of fertile top soil from fields. So, the practice of using kulhads has been discontinued.</p>		

• **OZONE DEPLETION**

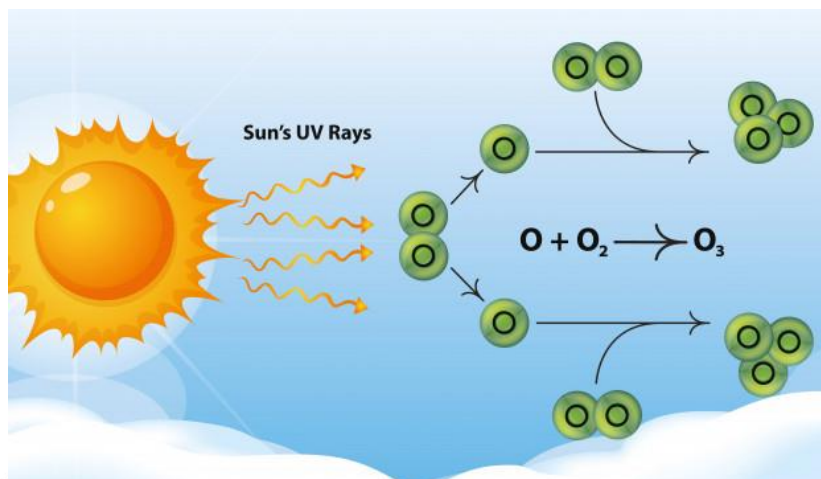
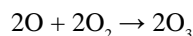
As we know that around 23 km from the surface of the earth there is a thick layer of ozone gas. **It is formed by the action of sun's rays on oxygen.** This thick layer of ozone also called **ozone blanket** is very effective in absorbing ultraviolet radiations given out by the sun. Thus, it protects the earth from the harmful effects of ultraviolet rays. In the year 1980 scientists noticed a 'hole' in the ozone blanket covering the upper surface around Antarctica. This fact is of great concern as harmful ultraviolet rays can now come to the earth through this hole. This will increase the level of UV-rays reaching the earth. An increased level of ultraviolet rays is very harmful as it can cause skin cancer and genetic disorders.

Main cause of depletion of ozone layer is chlorofluorocarbons (CFCs). Another cause of depletion of ozone layer is emissions from jet aeroplanes. Chlorofluorocarbons have the largest ozone depletion potential (ODP). Chlorofluorocarbons when released from air conditioners, refrigerators, spray cans and industrial solvents drift in the stratosphere very slowly. Therefore, each chlorine atom from chlorofluorocarbons gets enough time to destroy a large number of ozone molecules.

- Ozone in our atmosphere is formed by interaction between oxygen molecules and ultraviolet light as follows:



- Single atoms of oxygen are very reactive and combine with O_2 to form O_3 i.e., ozone



CAUSES OF OZONE DEPLETION

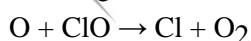
There are three main causes of ozone depletion:

1. **Human activity** is by far the most prevalent and destructive source of ozone depletion, while threatening volcanic eruptions are less common. Human activity, such as the release of various compounds containing chlorine or bromine, accounts for approximately 75 to 85 per cent of ozone damage. Perhaps the most evident and destructive molecule of this description is chlorofluorocarbon (CFC). CFCs were first used to clean electronic circuit boards, and as time progressed, were used in aerosols and coolants, such as refrigerators and air conditioners.

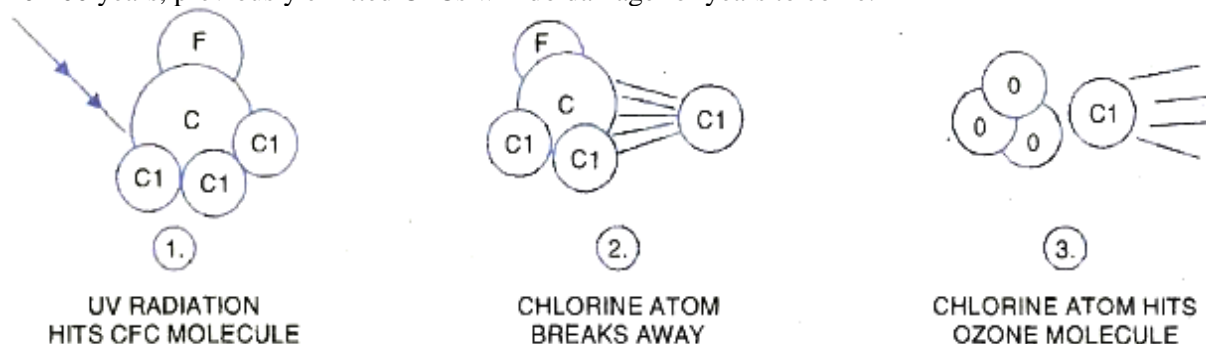
- When CFCs from these products are released into the atmosphere, the destruction begins.
- As CFCs are emitted, the molecules float toward the ozone rich stratosphere.
- Then, when UV radiation contacts the CFC molecule, this causes one chlorine atom to liberate.
- This free chlorine then reacts with an ozone (O_3) molecule to form chlorine monoxide (ClO) and a single oxygen molecule (O_2). This reaction can be illustrated by the following chemical equation

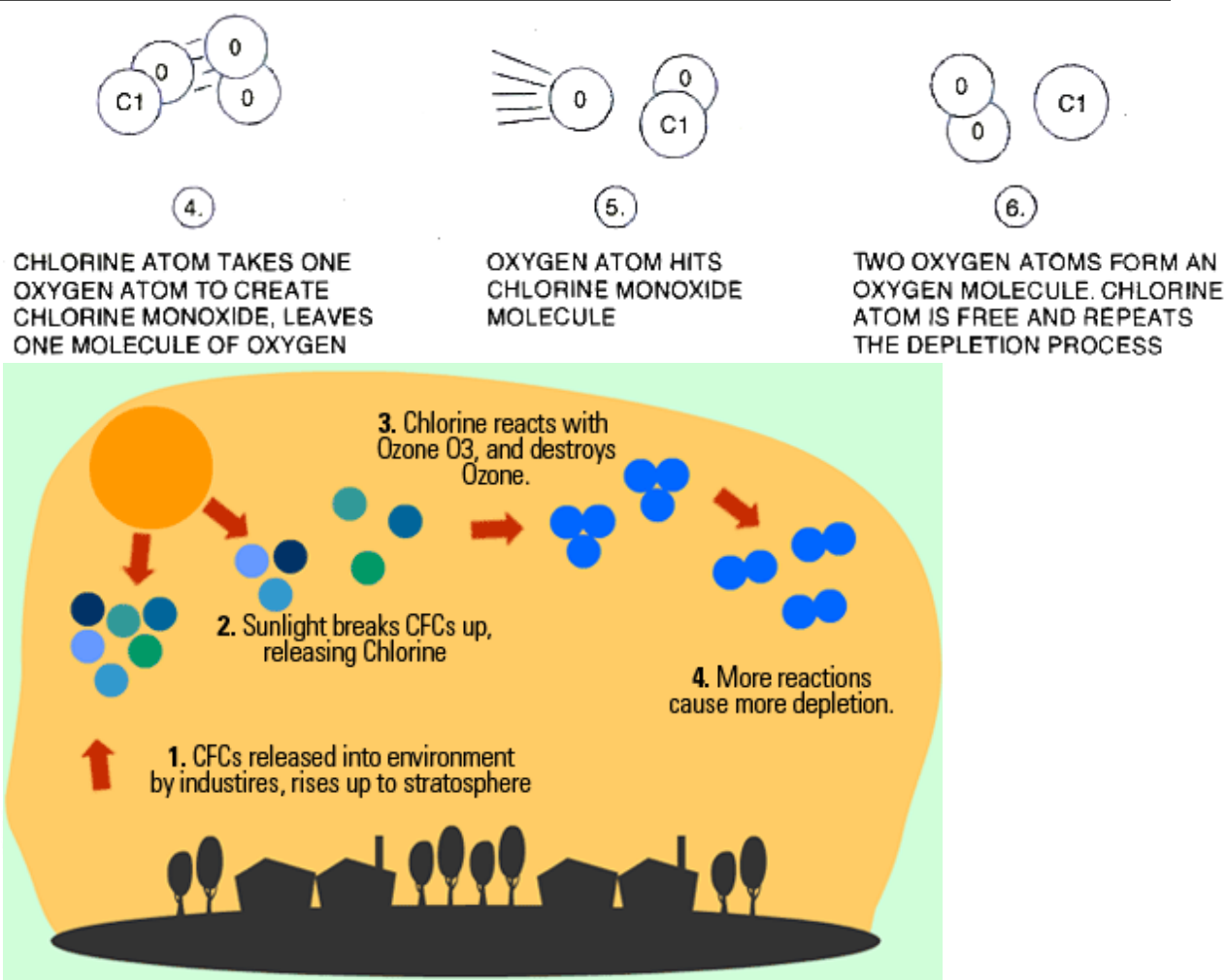


- Then, a single oxygen atom reacts with a chlorine monoxide molecule, causing the formation of an oxygen molecule (O_2) and a single chlorine atom



- This threatening chlorine atom then continues the cycle and results' in further destruction of the ozone layer.
- Measures have been taken to reduce the amount of CFC emission, but since CFCs have a life · span of 20-100 years, previously emitted CFCs will do damage for years to come.





- 2. Natural sources** also contribute to the depletion of the ozone layer, but not nearly as much as human activity. Natural sources can be blamed for approximately 15 to 20 per cent of ozone damage. A common natural source of ozone damage is naturally occurring chlorine.
- 3. Volcanic eruptions** are a small contributor to ozone damage, accounting for one to five per cent. During large volcanic eruptions, chlorine, as a component of hydrochloric acid (HCl), is released directly into the stratosphere, along with sulphur dioxide. In this case, sulphur dioxide is more harmful than chlorine because it is converted into sulphuric acid aerosols. These aerosols accelerate damaging chemical reactions, which cause chlorine to destroy ozone.

A Little further 3.4

Among the ozone depleting substances (ODS) chlorofluorocarbons are the most harmful. Give reason.

Explanation

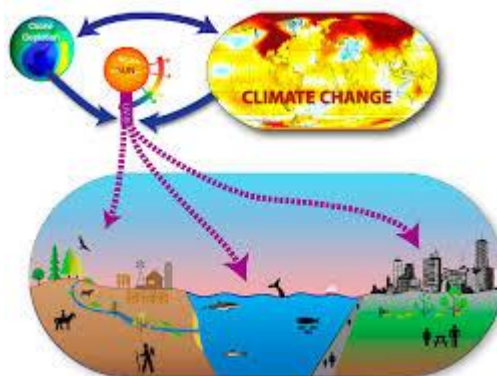
Chlorofluorocarbons produce 'active chlorine' (Cl and ClO radicals) in the presence of UV radiations. These radicals, through chain reactions, then destroy the ozone by converting it into oxygen. This is the reason why chlorofluorocarbons are the most harmful ODS.

IMPACT OF OZONE DEPLETION

Some of the environmental, social and economic effects of ozone depletion are:

- 1. Plant growth and productivity.** UV radiations can affect plant growth and productivity.
- 2. Marine food chain.** Phytoplankton's are microscopic plants that form the basis of the marine food chain. These are particularly susceptible to increases in UV radiation. Reduced phytoplankton numbers would significantly affect other marine species, including commercial fish stocks

3. **Human health.** At high exposure levels, UV radiations can weaken the human immune system and causes skin cancer, cataracts and eye cancer. Increased levels of UV radiation will contribute to rising Incidences of skin cancer.
4. **Deterioration of materials.** Increased UV radiations can accelerate the deterioration of plastics, wood, paper, cotton and wool.



CONTROL OF OZONE DEPLETION

The currently available substitutes of chlorofluorocarbons are hydro chlorofluorocarbons (HCFCs) and hydro fluorocarbons (HFCs). HCFCs contain one chlorine atom less than CFCs and are less harmful than CFCs. HFCs have no chlorine and hence ozone friendly. So, the ideal solution seems to be to use HFCs. But all the three gases are greenhouse gases and have global warming potential.

Montreal Protocol. In 1987, 27 countries signed international agreement to protect stratospheric ozone. The main points were:

- To limit the production and use of ozone depleting substances.
- Phasing out of ozone depleting substances
- Helping the developing countries to implement use of alternatives as CFCs.
-

• LAND POLLUTION

With the rise in population there has been increase in solid wastes from domestic and commercial wastes which lead to land pollution. It is a serious problem specially in large cities where disposable containers are used. Heaps of wastes are found to be lying here and there. Many of the wastes do not decompose at all while the organic wastes which decompose release foul smell. Few wastes when burnt, release harmful fumes. Problem of land pollution needs to be sorted out scientifically.



VARIOUS CAUSES OF LAND POLLUTION

1. Solid wastes from industrial, agricultural field etc.
2. Cow dung from cattle shed.
3. Sewage.
4. Various waste materials like plastics, papers, clothes, rubber, metals, peelings of fruits and vegetables are responsible for land pollution.
5. Unserviceable wooden articles.

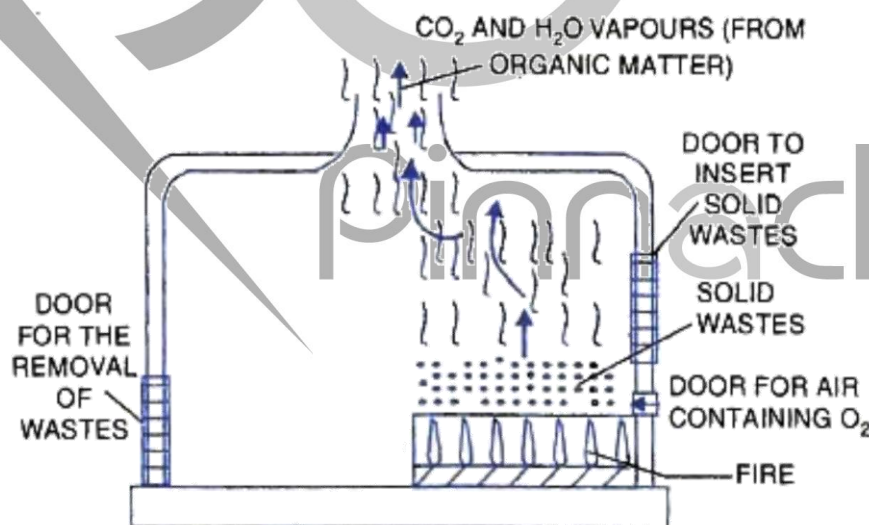
6. Leftover eatables.
7. Food items spoilt due to fungal growth.
8. Sand and bricks.
9. Empty bottles.
10. Leather goods.
11. Ash.

EFFECTS OF LAND POLLUTION

1. Foul smell released by decomposition of organic wastes.
2. Blocking of the flow of water in the drains.
3. Dirty surroundings.
4. Breeding grounds of houseflies, mosquitoes.
5. Consumption of polluted water leads to spreading of various water borne diseases like cholera, diarrhoea and dysentery.
6. Burning of some wastes leads to production of smoke which is harmful for health.
7. Certain chemicals like lead, sulphur which are released from various industries finally come to land and act as land pollutants.

CONTROL OF LAND POLLUTION

1. Use of biodegradable wastes.
2. Recycling of certain waste products like plastics and paper help in controlling water pollution.
3. Organic wastes can be sent to biogas plants.
4. Molten plastic wastes and asphalt can be used for making roads.
5. Volume of wastes can be reduced by burning them at high temperature. This is known as **incineration**. In this method huge volume of waste materials from houses, hospitals, industries are burnt and thus leaving behind less amount of ash. This can be done in an incinerator.



6. Biodegradable and non-biodegradable wastes should be disposed of separately.
7. Various metals can be melted and recycled.
8. Organic wastes can be buried and used as manure after the process of composting.
9. Use of manures and bio-fertilizers can reduce the need for chemical fertilizers.
10. By improving the mining techniques, spread of mine dust can be reduced.

MANAGEMENT OF GARBAGE PRODUCED

Solid wastes generated by domestic, commercial and industrial activities are often indiscriminately disposed. Unscientific management of such wastes leads to serious environmental problems. The problems are already acute in cities and towns, as the disposal facilities are not keeping pace with the

quantum of waste being generated. It is very common to find large heaps of garbage in disorganized manner at every nook and corner of the cities.

In sanitary method being adopted for disposal of solid wastes is a serious health concern. Particularly, during rainy season, run-off and high humid conditions increase the health hazards. The landfill sites, which are not well maintained, are prone to groundwater contamination due to leachate percolation. Open dumping of garbage serves as breeding ground for disease vectors such as flies, mosquitoes, cockroaches, rats and other pests.

High risks of spreading diseases like typhoid, cholera, dysentery, yellow fever, encephalitis, plague and dengue fever may not be ruled out. There are three major steps involved in the management of garbage viz. collection, transportation and disposal.

QUANTITY

It is estimated that solid waste generated in small, medium and large cities and towns is about 0.1 kg, 0.3-0.4 kg and 0.5 kg per capita per day respectively.

Description	Per cent by weight
Vegetable, leaves	40.15
Grass	3.80
Paper	0.81
Plastic	0.62
Glass, ceramics	0.44
Metal	0.64
Stones, ashes	41.81
Miscellaneous	11.73

COMPOSITION

The composition of garbage in India indicates lower organic matter and high ash or dust contents.

It has been estimated that recyclable content in solid wastes varies from 13 to 20% and combustible material is about 80-85%.

PRESENT GARBAGE MANAGEMENT PRACTICES

Collection of Garbage

Garbage is generated from residential and commercial complexes. Current practices in residential areas for collection of garbage differ from city to city.

Collection Centres

Each city has its own system for setting up of waste collection centres. The waste is collected from communities in a smaller bin, which is then transported, to larger bins known as secondary collection facility.

Transportation of Garbage

Transportation of waste from collection centres to final disposal site is another important step in the management of garbage. It has been estimated that approximately 60% of waste is collected for transportation to the disposal sites.

Disposal of Garbage

The disposal of garbage in a well-managed land, adopting scientific methods of operation is termed as sanitary land-fill (SLF). Most important aspect relating to landfill is, identification of a suitable site. Landfilling is a slow and time consuming process.

Most of the landfill sites in India are uncontrolled dumps and are not sanitary landfills where domestic, commercial; industrial and hospital wastes are dumped together. The garbage on such sites is not properly speedily and compacted. Thus, sites identified for filling are not properly maintained.

Community Participation

1. Creating mass awareness, ensuring public participation in segregation of recyclable material and storage of waste at source;
2. Ensuring public participation in community based primary collection system;
3. Organizing ragpickers for collection of recyclable material at the community level;
4. Providing health education to the ragpickers and suggesting tools for safety;
5. Providing employment through organizing door to door collection of waste; and encouraging minimization of waste through in-house backyard composting, vermiculture and biogas generation etc;
6. Recycling;
7. Wealth from wastes: technologies;
8. Sewage treatment includes the following three steps :

(a) Primary treatment.

It includes sedimentation, filtration, floatation and passing wastes through thick layer of gravel. After tries, sewage is neutralized.

(b) Secondary (Biological) treatment.

Neutralized material is sent to Up flow Anaerobic Sludge Blanket (UASB) where anaerobic bacteria act on biodegradable material. Mixing wastes with sludge containing bacteria and algae for consumption of organic matter and release of oxygen can prove to be useful in treatment of sewage. Digestion of organic material by bacteria is called biological or secondary treatment.

(c) Tertiary treatment.

Chlorination, evaporation, exchange and absorption constitute tertiary treatment. This treatment is meant for disinfection of the wastes and the removal of all inorganic wastes.

With changing time, we depend mainly on disposable and packed materials which are non-biodegradable. This has negative impact on our environment. Because of the rising problems arising as a result of disposal of non-biodegradable materials, like plastic cups used for tea, some alternative ways were thought. **Kulhads** made of clay replaced **plastic cups**. But later it was realized that making of lot of Kulhads led to loss of fertile top soil. This idea was dropped and presently disposable paper cups are used.

Pinnacle

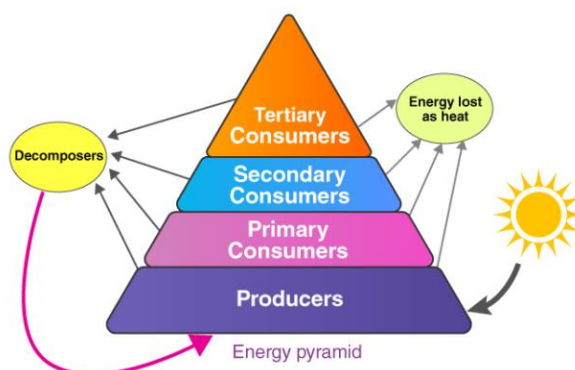
EXERCISE - 1

1. Why are some substances biodegradable and some non – biodegradable?
2. Give any two ways in which biodegradable substance would affect the environment.
3. Give any two ways in which non – biodegradable substance would affect the environment
4. What are trophic levels? Give an example of a food chain and state the different trophic levels in it.
5. What is the role of decomposers in the ecosystem?
6. What is ozone and how it affects the ecosystem?
7. How can you help in reducing the problem of waste disposal? Give any two methods.
8. Which of the following groups contain only biodegradable items?
 - (a) Grass, flowers and leather
 - (b) Grass, wood and plastic
 - (c) Fruit peels, cake and lime juice
 - (d) Cake, wood and grass
9. Which of the following constitute a food – chain?
 - (a) Grass, wheat and mango
 - (b) Grass, goat and human
 - (c) Goat, cow and elephant
 - (d) Grass, fish and goat
10. Which of the following are environments – friendly particles?
 - (a) Carrying cloth bags to put purchases in while shopping
 - (b) Switching off unnecessary lights and fans
 - (c) Walking to school instead of getting your mother to drop you on her scooter
 - (d) All of the above
11. What will happen if we kill all the organisms in one trophic level?
12. Will the impact of removing all the organisms in trophic level be different trophic levels? Can the organisms of any trophic level be removed without causing any damage to the ecosystem?
13. What is biological magnification? Will the levels of this magnification be different at different levels of the ecosystem?
14. What are the problems caused by the non – biodegradable wastes that we generate?
15. If all the waste we generate is biodegradable, will this have no impact on the environment?
16. Why is damage to the ozone layer a cause for concern? What steps are being taken to limit this damage?
17. What are trophic levels? Give an example of a food chain and state the different trophic levels in it.
18. What is ozone and how does it affect the ecosystem?
19. How can you help in reducing the problem of waste disposal? Give any two methods.
20. Why are crop fields known as artificial ecosystems?
21. Suggest one word for each of the following statements/ definitions
 - (a) The physical and biological world where we live in
 - (b) Each level of food chain where transfer of energy takes place
 - (c) The physical factors like temperature, rainfall, wind and soil of an ecosystem
 - (d) Organisms which depend on the producers either directly or indirectly for food
 - (e) What are the by-products of fertilizer industries? How do they affect the environment?
 - (f) Explain some harmful effects of agricultural practices on the environment.

EXERCISE - 2

• Ecosystem and Food chain

1. What is ecosystem?
2. List two man – made ecosystems.
3. What is meant by biological magnification?
4. List two natural ecosystems.
5. Why is forest considered as a natural ecosystem?
6. What are the various steps in a food chain called?
7. The first trophic level in a food chain is always a green plant. Why?
8. Consider a food chain consisting of: Wheat, Rat, Snakes and Peacock. What will happen if all the snakes are killed?
9. Mention the role of micro – organisms like bacteria and fungi.
10. What is an ecosystem? List its two main components. We do not clean natural ponds components but an aquarium needs to be cleaned regularly. Why is it so? Explain.
11. What is meant by food chain? “The number of trophic levels in a food chain is limited”. Give reason to justify this statement.
12. ‘Energy flow in food chains is always unidirectional’. Justify this statement. Explain how the pesticides enter a food chain and subsequently get into our body.
13. ‘Our food grains such as wheat and rice, the vegetables and fruits and even meat are found to contain varying amounts of pesticide residues’. State the reason to explain how and why it happens.
14. The flow of energy between various components of the environment has been extensively studied. Give an outline of the findings.
15. Your mother always thought that fruit juices are very healthy for everyone. One day she read in the newspaper that some brands of fruit juices in the market have been found to contain certain level of pesticides in them. She got worried as pesticides are injurious to our health.
 - (a) How would you explain to your mother about fruit juices getting contaminated with pesticides?
 - (b) It is said that when these harmful pesticides enter our body as well as in the bodies of other organisms they get accumulated and beyond a limit may cause harm and damage our organs. Name the phenomenon and write about it.
16. What is biodegradable substance?
17. Why are some substances non – biodegradable?
18. If 400,000 J of energy is available to Producers, then how much energy will be available to secondary consumers?



19. In the following food chain, plants provide 500 J of energy to rats. How much energy will be available to hawks from snakes?
Plants → Rats → Snakes → Hawks
20. What are ecological pyramids?

21. What is ten per cent law? Explain with an example.
22. Why Pyramid of energy is always upright?
23. A food chain consists of fish, larvae, phytoplankton's and birds. The level of pesticides in water in which the fish, larvae and phytoplankton's live is quite high.
 - (a) Which organism will have the maximum amount of pesticides accumulated through the food chain?
 - (b) Write the food chain comprising all the organisms mentioned above.

• **Ozone depletion and waste management**

24. What is the function of ozone in the upper atmosphere?
25. How is ozone formed in the upper part of the atmosphere of the earth?
26. You have been selected to talk on 'ozone layer and its protection' in the school assembly on 'Environment Day'.
 - (a) Why should ozone layer be protected to save the environment?
 - (b) List any two ways that you would stress in your talk to bring in awareness amongst your fellow friends that would also help in protection of ozone layer as well as the environment.
27. Why is damage to the ozone layer a cause for concern? What steps are being taken to limit the damage?
28. The gas A is used by most of the animals to obtain energy from food by the process of respiration. When A is acted upon by radiation X, it gets converted into another gas B which is an allotrope of A but poisonous when inhaled. B forms a kind of layer C in the upper atmosphere which absorbs radiations X coming from a source Y and prevents them from reaching the earth. Some chemicals Z released from the various devices on the earth are destroying the layer C slowly. In fact, a hole has already been formed in layer C over the area D of the earth.
 - (a) What are gases (i) A, and (ii) B? Write their molecular formulae.
 - (b) Name the layer c.
 - (c) What are (i) X, (ii) Y, and (iii) Z?
 - (d) Name of the area D.
 - (e) Name any two human ailments which may be caused by X.

Pinnacle

EXERCISE – 3

1. The effect of pollution is first and most marked on:
 - (a) Natural flora of a place
 - (b) Natural balance of our environment
 - (c) Natural geochemical cycles
 - (d) All of these
 2. Ozone layer is destroyed due to:
 - (a) CFC
 - (b) CO₂
 - (c) SO₂
 - (d) NH₃
 3. Threat for the existence of human being is:
 - (a) Dense forests
 - (b) High population and pollution
 - (c) Deforestation
 - (d) both b & c
 4. Air pollution is maximum caused by:
 - (a) Waste from kitchen
 - (b) Automobile exhausts and chemicals from industries
 - (c) Sewage
 - (d) None of these
 5. Which of the following groups contain only biodegradable items?
 - (a) Grass, flowers, plastic
 - (b) Glass, wood, plastic
 - (c) fruit peels, cake, lime juice
 - (d) Cake, polythene, grass.
 6. Which of the following constitute a food chain?
 - (a) Grass, wheat, mango
 - (b) Grass, goat, human
 - (c) goat, cow, elephant
 - (d) grass, fish, goat.
 7. Which of the following are environment friendly practices?
 - (a) Carrying cloth bags to put purchases in while shopping.
 - (b) Switching off unnecessary lights and fans.
 - (c) Walking to school instead of getting your mother to drop you on her scooter.
 - (d) All the above.
 8. Which of the following is an omnivorous animal?
 - (a) Deer
 - (b) Cat
 - (c) Lion
 - (d) Goat.
 9. Which of the following is not an abiotic component of ecosystem?
 - (a) Plants
 - (b) Soil
 - (c) Air
 - (d) Sunlight.
 10. Which of the following is a manmade ecosystem?
 - (a) Pond
 - (b) Aquarium
 - (c) Lake
 - (d) Forest.
 11. In pyramid of food, the producers occupy
 - (a) The base
 - (b) Position above the base
 - (c) Apex
 - (d) Position near apex
 12. Path of energy flow in an ecosystem is
 - (a) Herbivores → Producers → Carnivores → Decomposers
 - (b) Herbivores → Carnivores → Producers → decomposers
 - (c) Producers → Carnivores → Herbivores → Decomposers
 - (d) Producers → Herbivores → Carnivores → Decomposers
 13. Increasing concentration of accumulated pollutant along food chain is
 - (a) Biomagnification
 - (b) Degradation
 - (c) Eutrophication
 - (d) Nutrient cycling
 14. Pond is an example ofecosystem
 - (a) Artificial
 - (b) Natural
 - (c) Forest
 - (d) Grassland
 15. Main reason of disturbance of biological diversity
 - (a) Greenhouse effect
 - (b) Hunting
 - (c) Soil erosion
 - (d) Destruction of natural habitats
 16. Excessive exposure of humans to UV rays results in
 - (1) Damage to immune system
 - (2) Damage to lungs
 - (3) Skin cancer
 - (4) Peptic ulcers
 - (a) 1 and 2
 - (b) ii and 4
 - (c) 1 and 3
 - (d) 3 and 4
 17. Bhopal gas tragedy struck in the year 1984 due to the leakage of:
 - (a) Methyl – iso – cyanate
 - (b) Nitrous oxide
 - (c) Methane
 - (d) Carbon monoxide
-

18. What is the main source of water pollution in India?

- (a) Municipal sewage
- (b) Bathing
- (c) Industrial discharge
- (d) Both a & b

19. The conversion of nitrates to nitrogen gas by bacteria is called:

- (a) Denitrification
- (b) Nitrification
- (c) Nitrogen fixation
- (d) Excretion

20. _____fixes carbon in green plants as simple sugars.

- (a) Denitrification
- (b) Photosynthesis
- (c) Carbonation
- (d) Bacteria

21. Percentage energy transferred to higher trophic level in food chain is:

- (a) 1%
- (b) 10%
- (c) 90%
- (d) 100%

22. Climate change may have impact on

- (a) Agriculture, natural, terrestrial ecosystems and water resources.
- (b) Air quality, oceans, and coastal zones.
- (c) Energy and human health.
- (d) All of the above

23. Phosphates and nitrates entering a lake cause an explosive growth of algae, this is called:

- (a) Aestivation
- (b) Mutualism
- (c) Humus
- (d) An algal bloom

24. What compounds are identified as contributing to acid rain?

- (a) Carbon dioxide
- (b) Sulfur and nitrogen oxides
- (c) Mercury oxides
- (d) Phosphates

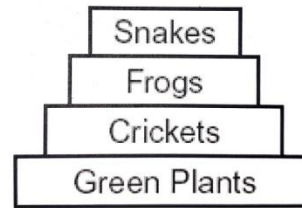
25. The way in which carbon is used and reused through the ecosystem is called:

- (a) Energy recycling
- (b) The energy pyramid

(c) The biotic/abiotic cycle

(d) The carbon cycles

26. The diagram below shows a food pyramid.



Which level of the food pyramid contains consumers with the least biomass?

- (a) Snakes
- (b) Frogs
- (c) Crickets
- (d) Green Plants

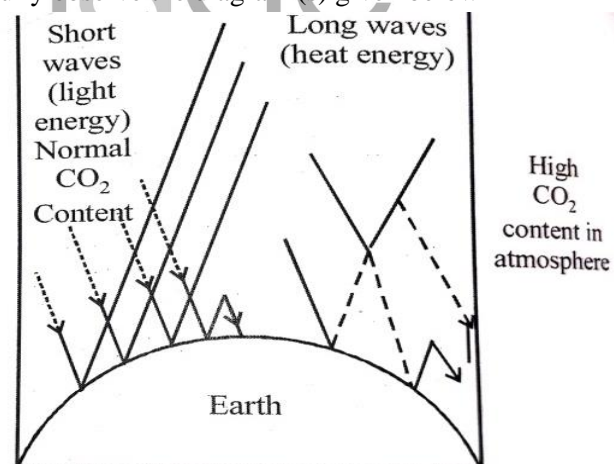
27. Which of the statement is incorrect?

- (a) All green plants and blue green algae are producers.
- (b) Green plants get their food from organic compounds.
- (c) producers prepare their own food from inorganic compounds.
- (d) Plants convert solar energy into chemical energy.

28. All consumers whether herbivores, carnivores or parasites depend on _____directly or indirectly for their sustenance by feeding on other consumers

- (a) Producers or plants
- (b) Air
- (c) Water
- (d) Light

29. carefully observe the diagram (s) given below



Following figure represents the phenomenon

- (a) Acid rain
- (b) Greenhouse effect
- (c) Ozone Depletion
- (d) None

PASSAGE – 1

Energy is the capacity to do work. Solar energy is transformed into chemical energy by the process of photosynthesis, and is stored in plant tissue and then transformed into mechanical and heat forms during metabolic activities.

The energy, in the biological world, flows from the sun the plants and then to all heterotrophic organisms such as microorganisms, animals and man. Energy flow is the key function in an ecosystem and it is unidirectional.

The study of energy transfer at different trophic level is known as ‘Bioenergetics’.

30. In the given food chain, suppose the amount of energy at fourth trophic level is 5 kJ, what will be the energy available at the producer level?

Grass → Grasshopper → Frog → Snake → Hawk

- (a) 5 kJ (b) 50 kJ
(c) 500 kJ (d) 5000 kJ

31. Flow of energy in an ecosystem is always

- (a) Unidirectional
- (b) Bidirectional
- (c) Multi – directional
- (d) No specific direction

32. In a food chain, the third trophic level is always occupied by

- (a) Carnivores (b) Herbivores
(c) decomposers (d) Producers

33. Which of the following is non-biodegradable substance?

- (a) polythene (b) cotton cloth
(c) leaves (d) vegetable peels

34. In a terrestrial ecosystem, green plants capture 1% of the energy of sunlight that falls on their leaves and convert it into

- (a) Food energy (b) muscular energy
(c) Electrical energy (D) potential energy

35. Greater use of disposable packaging materials is affecting the environment because

- (a) They are more convenient to use
- (b) They are increasing non-biodegradable waste.
- (c) They are hygienic and non-toxic for humans.
- (d) All of these

EXERCISE – 4

1. Which is correct food chain?
 - (e) Phytoplankton → Fishes → Zooplankton
 - (f) Zooplankton → Phytoplankton → Fishes
 - (g) Phytoplankton → Zooplankton → Fishes
 - (h) Fishes → Zooplankton → phytoplankton
2. Consider the following statements concerning food chains
 - (1) Removal of 80% tigers from an area resulted in greatly increased growth of vegetation.
 - (2) Removal of most of the carnivores resulted in an increased population of deers.
 - (3) The length of food chains is generally limited to 3 – 4 trophic levels due to energy loss.
 - (4) The length of food chains may vary from 2 to 8 trophic levels.Which two of the above statements are correct?
 - (a) 1, 4
 - (b) 1, 2
 - (c) 2, 3
 - (d) 3, 4
3. Maximum DDT is found in birds feeding on
 - (a) Fishes
 - (b) Meat
 - (c) Insects
 - (d) Seeds
4. In an aquatic environment, microscopic animals and plants are collectively known as
 - (a) Commensals
 - (b) Herbivores
 - (c) Fauna and Flora
 - (d) Planktons
5. Maximum photosynthesis takes place by
 - (a) Phytoplankton
 - (b) Zooplankton
 - (c) Marsh plants
 - (d) Woody plants
6. Peacock eat a snake and snake eat frog and frog eats insect while insect eats green plant, then position of peacock is
 - (a) Primary producer
 - (b) Secondary producers
 - (c) Decomposer
 - (d) Top at the apex of food pyramid
7. A lake near a village suffered heavy mortality of fishes within a few days. Consider the following reasons for this?
 - (1) Lots of urea and phosphate fertilizer were used in the crops in the vicinity.
 - (2) The area was sprayed with DDT by aircraft.
 - (3) The lake water turned green and stinky.
 - (4) Phytoplankton populations in the lake declined initially thereby greatly reducing photosynthesis.
 - (a) 1, 3
 - (b) 1, 2
 - (c) 2, 3
 - (d) 3, 4
8. What is B.O.D.?
 - (a) The amount of O₂ utilized by organisms in water.
 - (b) The amount of O₂ utilized by microorganisms for decomposition.
 - (c) The total amount of O₂ present in water.
 - (d) All of above
9. Lichens can be used as
 - (a) Bioindicator for water pollution.
 - (b) Final vegetation for waste lands.
 - (c) Source of wood.
 - (d) Bioindicator for air pollution.
10. Ozone of ozonosphere is formed from
 - (a) Nitrogen oxides and Oxygen
 - (b) Chlorine, Water and Oxygen
 - (c) Oxygen and Oxygen
 - (d) All the above
11. Which of the following indications of the health of a water body is the most widely accepted means of measuring how polluting an effluent is?
 - (a) COD (chemical oxygen demand)
 - (b) BOD (biological oxygen demand)
 - (c) Chloroform content
 - (d) None of the above
12. Materials of biological origin which are commonly used to maintain and improve soil fertility are:
 - (a) Green manure
 - (b) Biofertilisers
 - (c) Bioinsecticides
 - (d) Both a & b
13. Why is it difficult to integrate nitrogen gas from the atmosphere into the nitrogen cycle of the biosphere?

- (a) Nitrogen is not very abundant in the atmosphere.
- (b) Few organisms can directly utilize atmospheric nitrogen gas.
- (c) Oceans quickly absorb nitrogen gas.
- (d) Living organisms quickly absorb nitrogen gas.
14. A layer of air known as the atmosphere surrounds the earth. The composition of the atmosphere can be changed by air pollution. Which of the following statements about air pollution are correct?
- It affects the weather.
 - It covers the leaves of plants and limits photosynthesis.
 - It may cause breathing difficulties and diseases of the respiratory tract.
 - It is mostly caused by the burning of fossil fuels.
- (a) iii & iv (b) I, ii, & iii
- (c) I, iii & iv (d) I, ii, iii, & iv
15. The process of photosynthesis and respiration cause the cycling of _____ through the environment.
- (a) Carbon (b) Water
- (c) Nitrogen (d) Hydrogen
16. Which of the human activity has added the most carbon to the atmosphere?
- (a) Burning fossil fuels
- (b) Mining fossil fuels
- (c) Increasing soil erosion
- (d) None of these
17. In nutrient cycles, generally, minerals tend to be dispersed through:
- (a) Plant action
- (b) Surface and sub – surface run – off
- (c) Evaporation
- (d) Assimilation
18. pH value of acid rain is:
- (a) 11 – 12
- (b) 3 – 6
- (c) 7 – 8
- (d) 10 – 11
19. Over the last 100 years global sea level has risen by about?
- (a) 20 – 25 cm
- (b) 10 – 12.5 cm
- (c) 25 – 50 cm
- (d) None of these
20. On the basis of following features identify correct option.
- (I) They decompose into soil
- (II) They are degraded by microorganisms such as bacteria and fungi.
- (III) They are not biologically magnified.
- (a) Non-biodegradable wastes
- (b) Biodegradable wastes
- (c) Biomedical wastes
- (d) Commercial wastes

EXERCISE – 3

Ques.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Ans.	d	a	d	b	c	b	d	b	a	b
Ques.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.
Ans.	a	d	a	b	d	c	a	d	a	b
Ques.	21.	22.	23.	24.	25.	26.	27.	28.	29.	30.
Ans.	b	d	d	b	d	c	b	a	b	d
Ques.	31.	32.	33.	34.	35.					
Ans.	a	a	a	a	b					

EXERCISE – 4

Ques.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Ans.	c	c	c	d	a	d	a	b	d	c
Ques.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.
Ans.	b	d	b	d	a	a	b	b	b	b