

SHORT QUESTIONS

1. What are the different levels of ecological organization?

Ans: Levels of Ecological Organization:

In ecology, the levels of organization range from organism to biosphere. An organism may be unicellular or multicellular

Population:

A group of the organisms of the same species inhabiting a specific geographical area (habitat) at a particular time is called a population

Community:

All the populations that live in a habitat and interact in various ways with one another are collectively called a community

2. Define ecosystem and its components.

Ans: The self-sufficient unit of an environment that is formed as a result of interactions between its biotic community and the abiotic components is known as an ecosystem.

Components of Ecosystem:

Ecosystem comprises of two basic parts i.e.

- i. Abiotic Components
- ii. Biotic Components

Abiotic components:

The abiotic components include the non-living factors present in ecosystem. The important non-living factors are light, air, water, soil and the basic elements and compounds

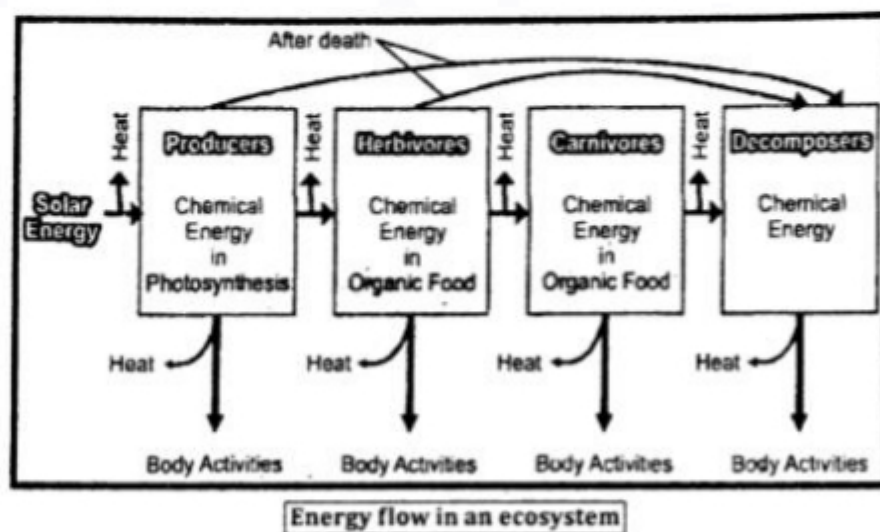
Biotic Components:

The biotic components comprise the living part (organisms) of the ecosystem. Biotic components are further classified as producers, consumers and decomposers.

3. How the flow of energy is different from that of materials?

Ans: Flow of Energy in Ecosystem:

The flow of energy in different trophic levels of ecosystem is unidirectional. The following is an overview of the flow of energy in an ecosystem



Sun is the primary source of energy:

The Sun is the primary source of energy for all ecosystems. Producers get solar energy and transform it into chemical energy by the process of photosynthesis. They store this energy in their tissues and also transform it into mechanical and heat energy during their metabolic activities.

Flow of energy in producers:

The energy in producers' tissues flows to herbivores when producers are eaten. Herbivores transform it into mechanical and heat energy during their metabolic activities and store the rest in their tissues. Carnivores eat herbivores and get energy. They also use it for their body activities and store the rest in their tissues. After the death of producers and consumers, the energy stored in their tissues is used by decomposers.

Law of Thermodynamics:

The storage and expenditure of energy in an ecosystem is in accordance with the basic law of thermodynamics i.e. 'energy can neither be created nor destroyed but can be transformed from one form into another

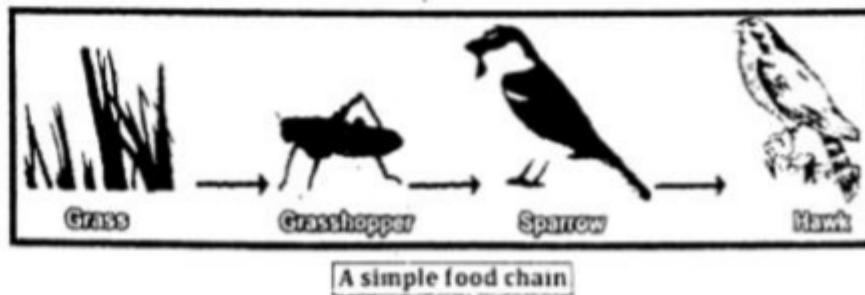
Note:

In an ecosystem there is,

- i. Constant flow or transfer of energy from the Sun through producers to consumers and decomposers
- ii. A significant decrease in useful energy during transfer of energy at each trophic level

Flow of Materials:

The materials flow from one trophic level to the next by means of food chains and food webs. A food chain is a series of organisms within an ecosystem, in which each organism feeds on the one before it and is fed by the one after it. For example, following is a food chain in an ecosystem:



The base of food chain is always formed by a plant (producer) It is eaten by a primary consumer, which is preyed upon by a secondary consumer. The secondary consumer may be eaten by a tertiary consumer

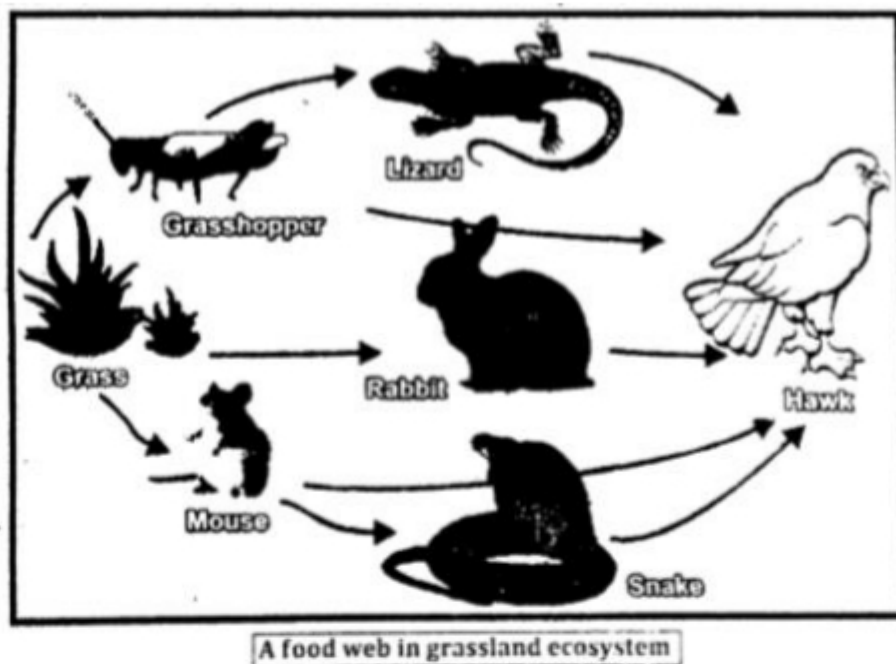
A food chain, can therefore, be represented as

Producer - Primary Consumer - Secondary Consumer - Tertiary Consumer

A food chain involves a nutritive interaction among the biotic components of an ecosystem Usually there are 4 or 5 trophic levels. Shorter food chains provide greater available energy and vice-versa,

Food web:

In nature, food chains are very complex, as one organism may be the food source of many other organisms. Thus, instead of a simple linear food chain there is a web-like structure formed by these interlinked food chains Such interconnected food chains collectively make food web' Food web can be defined as "a network of food chains which are interconnected at various trophic levels



4. Define food chain and food web.

Ans: Food chain:

The series of organisms in an ecosystem, in which an organism eats the preceding one and is eaten by the next one is called food chain.

Food web:

A network of interconnected food chains has a number of feeding connections amongst different organisms of a community is called food web.

OR (Second Answer)

Food Chain:

A simple chain of feeding relationship between three or four organisms is called a food chain

Food Web:

A food web is a diagram, of some sort, that links at least two food chains together. Food webs describe how energy is passed throughout a section of an ecosystem (or an entire ecosystem)

5. What do you mean by the concept of 3Rs with reference to the conservation of natural resources?

Ans: To ensure sustainable use of resources in our environment, we should act upon the principle of the 3R' i.e. Reduce, Reuse, and Recycle.

The R1: Reduce:

We should use the natural resources less and should not waste them. We should use this principle at different places, in our daily lives. We should not waste water, electricity, fuel etc.

We should turn off the tap when not in use. We should bathe with a bucket instead of shower lights and fans should be off, when we are not in room. We should take public transport (like buses) or walk short distances instead of using motor fuel. We should not waste food and should give unused food to poor people.

The R2: Reuse:

We should use things again and again. We should not throw away materials such as glass containers, plastic bags, paper, cloth etc. These should be reused at domestic levels rather than being thrown. It also reduces solid waste pollution

The R3: Recycle:

Materials such as paper, plastic, glass etc. can be recycled. This decreases the volume of refuse and helps in the conservation of natural resources

UNDERSTANDING THE CONCEPT

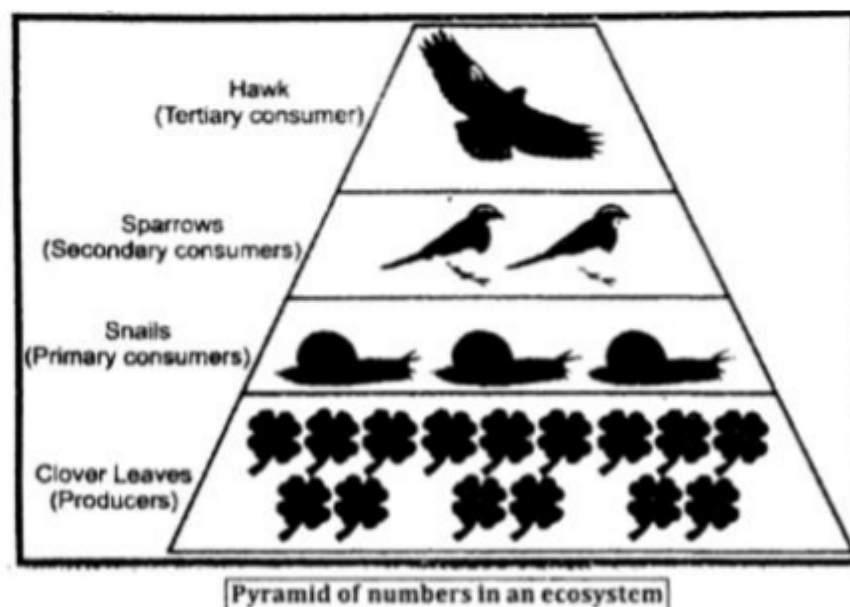
1. Explain what do you mean by the pyramids of number and biomass.

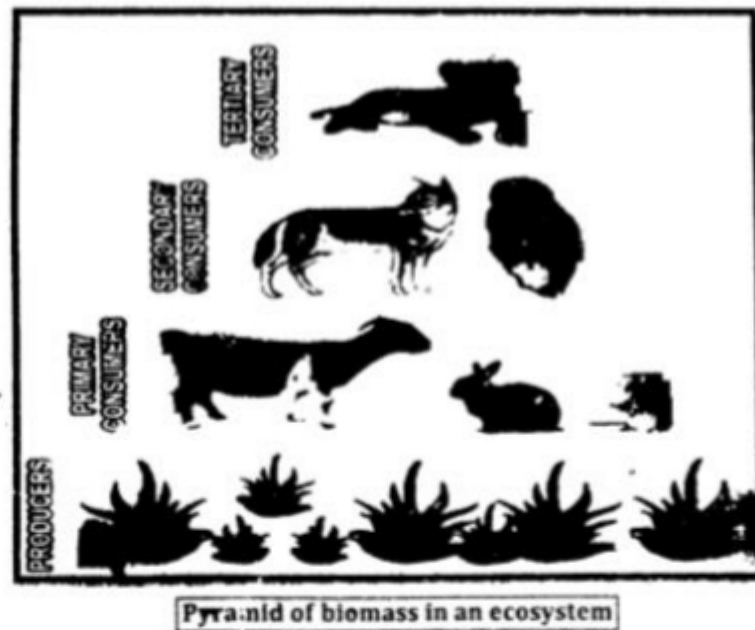
Ans: i. Pyramid of Numbers:

It is the graphic representation of the number of individuals per unit area at various trophic levels. Usually, producers are present in large number, primary consumers are in lesser number, secondary consumers are fewer, and so on. So, the producers are of smallest size but maximum in number, while the tertiary consumers are larger in size but lesser in number.

ii. Pyramid of Biomass:

It is the graphic representation of biomass present per unit area at different trophic levels. In a terrestrial ecosystem, the maximum biomass occurs in producers, and there is progressive decrease in biomass from lower to higher trophic levels.





2. Write a note on Carbon cycle.

Ans: Carbon cycle:

The biogeochemical cycle in which carbon flows between organisms and the environment is called carbon cycle

Carbon atom is the principal building block of many kinds of biomolecules. Carbon is found as graphite and diamond in nature. It also occurs as carbon dioxide in atmosphere.

Major source of carbon:

Major source of carbon for the living world is carbon dioxide present in atmosphere and water. Fossil fuels like peat, coal, natural gas and petroleum also contain carbon. Carbonates of Earth's crust also give rise to carbon dioxide.

Photosynthesis and Carbon:

The major process that brings carbon from atmosphere or water into the live world is photosynthesis. Producers take in carbon dioxide from atmosphere and convert it into organic compounds. In this way, carbon becomes a part of the

body of producers This carbon enters food chains and is passed to herbivores, carnivores and decomposers

Respiration:

Carbon dioxide is released back to environment by respiration of producers and consumers. It is also released by the decomposition of organic wastes and dead bodies by decomposers.

Combustion:

Burning of wood and fossil fuels also adds large amount of carbon dioxide into atmosphere

Greenhouse effect and global warming:

Human activities have contributed to the loss of balance in nature because the balance of carbon cycle has been upset by human activities such as deforestation and excessive burning of fossil fuels. As a result, the amount of carbon dioxide in atmosphere is increasing, causing the green house effect and global warming

Note: Carbon cycle is a perfect cycle in the sense that carbon is returned to atmosphere as soon as it is removed.

3. What are the different stages of Nitrogen cycle?**Ans: Stages of Nitrogen cycle:**

Nitrogen cycling involves several stages

a. Formation of Nitrates:

It is done by the following ways

i. Nitrogen Fixation:

Conversion of nitrogen gas into nitrates is called nitrogen fixation It occurs in the following ways

a. Atmospheric nitrogen fixation:

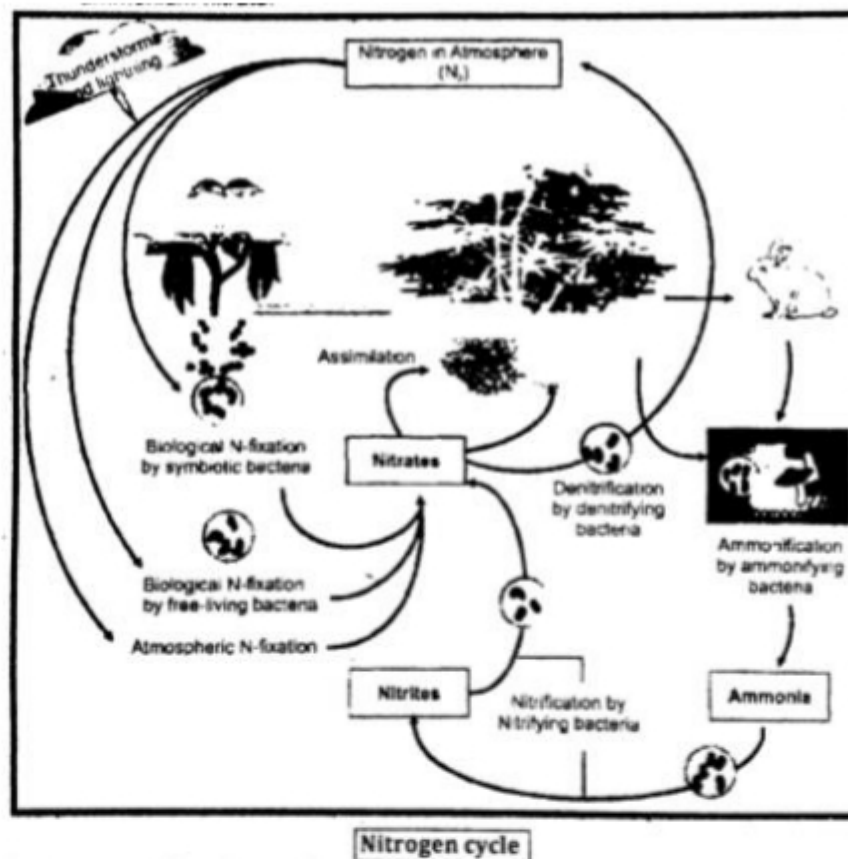
Thunderstorms and lightning convert atmospheric gaseous nitrogen to oxides of nitrogen. These oxides dissolve in water and form nitrous acid and nitric acid. The acids in turn combine with other salts to produce nitrates it is called as atmospheric nitrogen fixation

b. Biological nitrogen fixation:

Some bacteria also have the ability to transform gaseous nitrogen into nitrates It is called biological nitrogen fixation Some of these nitrogen fixing bacteria live as symbionts and many are free-living

c. Industrial nitrogen fixation:

Nitrogen fixation is also done in industries in industrial nitrogen fixation, hydrogen is combined with atmospheric nitrogen under high pressure and temperature. It produces ammonia which is further converted into ammonium nitrate



ii. **Ammonification and Nitrification:**

Ammonification is the breakdown of the proteins of dead organisms and nitrogenous wastes (urea uric acid etc) to ammonia. It is done by ammonifying bacteria. After the formation of ammonia, it is converted into nitrites and nitrates; it is called nitrification and is done by nitrifying bacteria. First, ammonia is converted into nitrites by bacteria (e.g. *Nitrosomonas*). The nitrites are then converted into nitrates by other bacteria (e.g. *Nitrobacter*).

b. **Assimilation:**

The nitrates formed by the above processes, are absorbed by plants and are utilized for making proteins etc. Animals take nitrogenous compounds from plants. The utilization of nitrates by organisms is called assimilation.

c. **Denitrification:**

It is a biological process in which nitrates and nitrites are reduced to nitrogen gas by denitrifying bacteria. By this process, nitrogen is returned to atmosphere

Note:

Excessive denitrification reduces soil fertility and is stimulated by water logging, lack of aeration and accumulation of organic matter in the soil

4. Write notes on competition, predation and symbiosis.

Ans: i. Competition:

In ecosystems, the natural resources e.g. nutrients, space etc. are usually in short supply. So there is a competition among the organisms of ecosystem for the utilization of resources. The competition may be intraspecific or interspecific.

Intraspecific competition is always stronger and more severe than the interspecific competition. Competition helps in maintaining a balance between the available resources and the number of individuals of a species.

Plants also show competition for space, light, water and minerals.

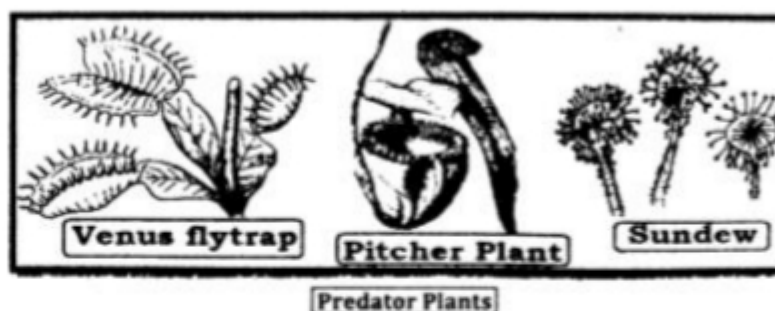
ii. Predation:

It is an interaction between two animals of different species or between a plant and an animal. In predation, one organism (the predator) attacks, kills and feeds on other organism (the prey).

Some examples of predation are given below.

- a.** All carnivore animals are predators. For example, frog preys upon mosquito and fox preys upon rabbit. There are some examples where a predator is preyed upon by a second predator and then the second one is preyed upon by a third predator. For example, frog (predator 1) is preyed upon by a snake (predator 2) and the snake is preyed upon by an eagle (predator 3).

- ii. Certain plants (Pitcher plant, sundew, Venus fly trap etc.) are carnivorous and live as predators. Such plants live in the areas where minerals and other nutrients are lacking. They feed on insects to fulfill their nitrogen requirements. These plants have mechanism to attract insects. For example, they secrete sweet nectar that attracts the insects searching for food. Their leaves are also modified to capture the prey.



Note:

Predation keeps the prey population under check so as to maintain an ecological balance. Humans benefit from this interaction in the biological control of weeds and pests. In order to control pests in an area, their predators are released there.

iii. Symbiosis:

It is a relationship between members of different species, in which they live together for longer or shorter periods of time.

Types of Symbiosis:

Symbiosis is of three types

a. Parasitism:

It is a type of symbiosis (between members of different species) in which smaller partner (parasite) derives food and shelter from the body of larger partner (host) and, in turn, harms it.

Temporary Parasitism:

in temporary parasitism, the parasite spends most of its life cycle as independent free-living organisms. Only a part of its life cycle is spent as a parasite. Leech, bed bug, mosquito are common temporary parasites of humans.

Permanent Parasitism:

In permanent parasitism, the parasites spend their whole life cycle as parasites. Many disease-causing bacteria and all viruses are permanent parasites.

Classification of Parasites:

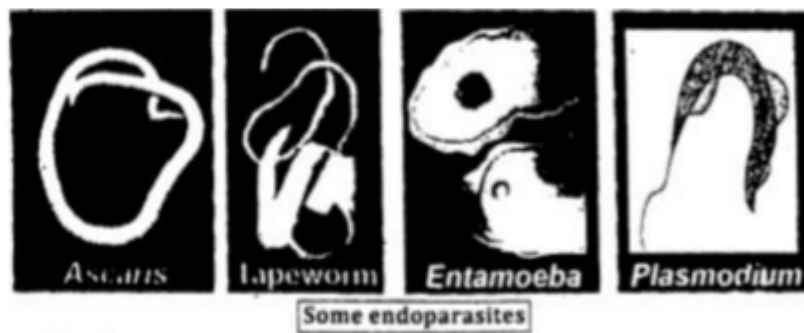
Parasites may also be classified as ectoparasites and endoparasites.

Ectoparasites:

Ectoparasites live outside the body on the surface of host's body and get food from there. Mosquitoes, leeches, lice etc. are the examples of ectoparasites.

Endoparasites:

Endoparasites live inside the body of host and get food and shelter. Bacteria, viruses, tapeworm, Ascaris, Entamoeba, Plasmodium etc. are the examples of endoparasites.



Parasitic plants:

Some plants (e.g. Cuscuta, also called dodder) are parasites on other plants. Parasitic plants grow special types of roots (haustoria) into host body and suck the required nutrients from the vascular tissues of host.

Note: Host can survive without parasite, but parasite cannot survive without host
b.

b. Mutualism:

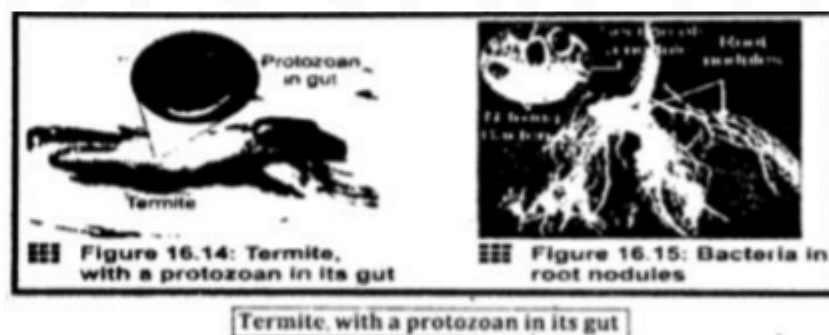
In this type of symbiotic interaction, both partners (of different species) get benefit and neither is harmed

For example:

Termites eat wood but are not able to digest it. A protozoan life in its intestine. It secretes 'cellulase' enzyme to digest the cellulose of wood. In return, the termite provides food and shelter to the protozoan.

Rhizobium:

The nitrogen fixer bacteria *Rhizobium* lives in the root nodules of leguminous plants like pea, gram etc. The bacteria obtain food and shelter from plants while in return they fix gaseous nitrogen into nitrates for the plant which is required for their growth.



C. Commensalism:

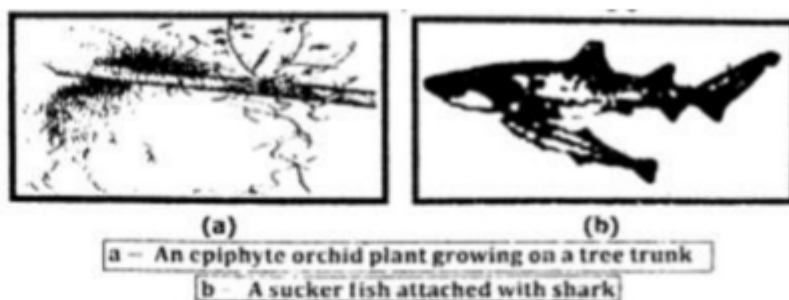
It is a type of symbiosis in which one partner is benefited while the other is neither benefited nor harmed. For example

Epiphytes:

Epiphytes are small plants found growing on other larger plants for space only. They absorb water and minerals from the atmosphere and prepare their own food. The larger plants are neither benefited nor harmed in any way.

Sucker fish:

Sucker fish attaches to the surface of sharks by its sucker in this way, the shark provides easy transport to the sucker fish to new feeding grounds



5. Explain how human activities have contributed to the loss of balance in nature.

Ans: Loss of balance in nature:

Human activities contribute to climate change by causing changes in Earth's atmosphere in the amounts of greenhouse gases, aerosols (small particles), and cloudiness

The largest known contribution comes from the burning of fossil fuels, which releases carbon dioxide gas to the atmosphere. Greenhouse gases and aerosols affect climate by altering incoming solar radiation and out-going infrared (thermal) radiation that are part of Earth's energy balance. Changing the atmospheric abundance or properties of these gases and particles can lead to a warming or cooling of the climate system.

Greenhouse Gases:

Human activities result in emissions of four principal greenhouse gases carbon dioxide (CO₂), methane (CH₄), Nitrous oxide (N₂O) and the halocarbons (a group of gases containing fluorine, chlorine and bromine). These gases accumulate in the atmosphere, causing concentrations to increase with time.

Significant increases in all of these gases have occurred in the industrial era. All of these increases are attributable to human activities.

Carbon dioxide has increased from fossil fuel use in transportation, building heating and cooling and the manufacture of cement and other goods. Deforestation releases CO_2 and reduces its uptake by plants. Carbon dioxide is also released in natural processes such as the decay of plant matter.

Methane has increased as a result of human activities related to agriculture, natural gas distribution and landfills. Methane is also released from natural processes that occur, for example, in wetlands. Methane concentrations are not currently increasing in the atmosphere because growth rates decreased over the last two decades.

Nitrous oxide is also emitted by human activities such as fertilizer use and fossil fuel burning. Natural processes in soils and the oceans also release N_2O .

The abundance of chlorofluorocarbon gases is decreasing as a result of international regulation designed to protect the ozone layer.

Ozone is a greenhouse gas that is continually produced and destroyed in the atmosphere by chemical reactions. In the troposphere, human activities have increased ozone through the release of gases such as carbon monoxide, hydrocarbons and nitrogen oxide which chemically react to produce ozone. As mentioned above, halocarbons released by human activities destroy ozone in the stratosphere and have caused the ozone hole over Antarctica.

6. Write note on the causes and effects of the air and water pollutions.

Ans: 1. Air Pollution:

Air pollution is one of the major environmental issues of today. It is defined as the change of composition of air by the addition of harmful substances (e.g. industrial and automobile gases and particulate matter).

Sources of Air Pollution:

All sources of air pollution, are related to human activities. Burning of coal produces a lot of smoke and dust whereas burning of petroleum produces sulphur dioxide

In addition to these, air pollutants include carbon monoxide, carbon dioxide, nitrogen oxides, hydrocarbons, particulate matter and traces of metals. Different industries produce air pollution in the following way.

Fertilizer industries release oxides of sulphur and nitrogen, hydrocarbons, particulate matter and fluorine,

Thermal industries are coal based and their pollutants are fly ash, soot and sulphur dioxide

Textile industries release cotton dust, nitrogen oxides, chlorine, smoke and sulphur dioxide

Steel industries release carbon monoxide, carbon dioxide, sulphur dioxide, phenol, fluorine, cyanide, particulate matter etc.

Effects of Air Pollution:**i. Smog formation:**

When pollutants like hydrocarbons and nitrogen oxides combine in the presence of sunlight, smog is formed. This is a mixture of gases. It forms a yellowish-brown haze especially during winter and hampers visibility. It also causes many respiratory disorders and allergies as it contains polluting gases

ii. Acid rains:

The air pollutants like sulphur dioxide and nitrogen oxides react with water in the atmosphere producing acid rains

iii. Ozone depletion:

The upper layer (stratosphere) of the atmosphere has ozone (O₃) which absorbs ultraviolet (UV) rays present in the sun's radiation. However, the air pollutants like chlorofluorocarbons (CFCs) destroy the ozone molecules and so break the ozone layer. Ozone holes are created which permit UV rays to reach the Earth's surface. The UV rays increase the temperature and also cause skin cancers.

The harmful effects of the UV rays are visible in the countries such as Australia and New Zealand where the rate of skin cancer is higher than the other regions of the world.

Control of Air Pollution:

For effective control of air pollution, it is important to create public awareness about the ill-effects of air pollution. Air pollution can be controlled by the following ways

i. Afforestation:

It means the establishment of new forests by planting on non-forest areas. Forests are effective means to control air pollution because plants can filter and absorb air pollutants.

ii. Modification of industrial effluents:

The air pollutants coming from industries should be passed through filters and other devices, so that the particulate matter is removed before the waste gases are released out. The smoke producing units should have long chimneys to take the polluting gases far above and then disperse over a larger area. Industries should also invest for solar cookers or for producing bio gas.

iii. Environment friendly fuels:

Lead-free fuels should be used in automobiles. Similarly, sulphur-free fuel should be used in coal-based industry to reduce pollution by sulphur dioxide

2. Water Pollution:

It is the change in the composition of water by the addition of harmful substances. Water pollution severely affects the health of people.

Major pollutants of water:

Sewage is one of the major pollutants of water. It contains organic matter and the excreta of human and other animals. Organic matter encourages the growth of microorganisms which spread diseases.

The wastes of industries (acids, alkalis, dyes and other chemicals) are disposed in nearby water bodies. These wastes change the pH of water and are harmful or even fatal to aquatic organisms.

Certain industries release a lot of hot water from their cooling plants. It results in heating up of water bodies and kills aquatic life.

Fertilizers and pesticides enter into water bodies with the rain water flow and the ground water by seepage. These chemicals remain in water for a long time and can enter food chains. They cause a number of diseases in animals.

Oil tankers and offshore petroleum refineries cause oil leakage into water. Oil floats on the water surface and prevents atmospheric oxygen from mixing in water. So, aquatic animals begin to die due to oxygen shortage.

Some heavy metals e.g. lead, mercury, arsenic and cadmium also make the water polluted. Such metals can be present in the water released from industrial and urban areas.

If water with such heavy metals is given to plants, the metals enter the vegetables that grow on these plants. Such contaminated vegetables are harmful for human health. Heavy metals reduce growth and development, and cause cancer and nervous system damage. Mercury and lead can cause joint diseases such as rheumatoid arthritis, and diseases of kidneys, circulatory system and nervous system.

Effects of Water Pollution;

The following are major effects of water pollution

i. Eutrophication:

Enrichment of water with inorganic nutrients (nitrates and phosphates) is called eutrophication. The sewage and fertilizers contain large amount of inorganic material (nutrients). When sewage and fertilizers reach water bodies, the nutrients present in them promote algal blooms (excessive growth) there (Fig 16.19). Rich algal growth leads to increase in the number of the decomposers. Decomposers use the oxygen present in water and it results in the depletion of oxygen. Algal bloom also reduces the light reaching the lower layers in water.

ii. Food chain contamination:

The non-biodegradable water pollutants may stay in water for long times. From water, they enter into small organisms, which are fed upon by fish. The fish in turn are fed upon by land animals including human.

iii. Epidemics:

Organic pollutants in water facilitate the growth of germs. Such polluted water causes epidemics like cholera, gastroenteritis etc.

Control of Water Pollution:

Public should be made aware of the dangers of water pollution Before releasing the sewage into water bodies it must be purified through sewage treatment techniques Industrial wastes should also be treated before they are released into water bodies

ClassNotes

