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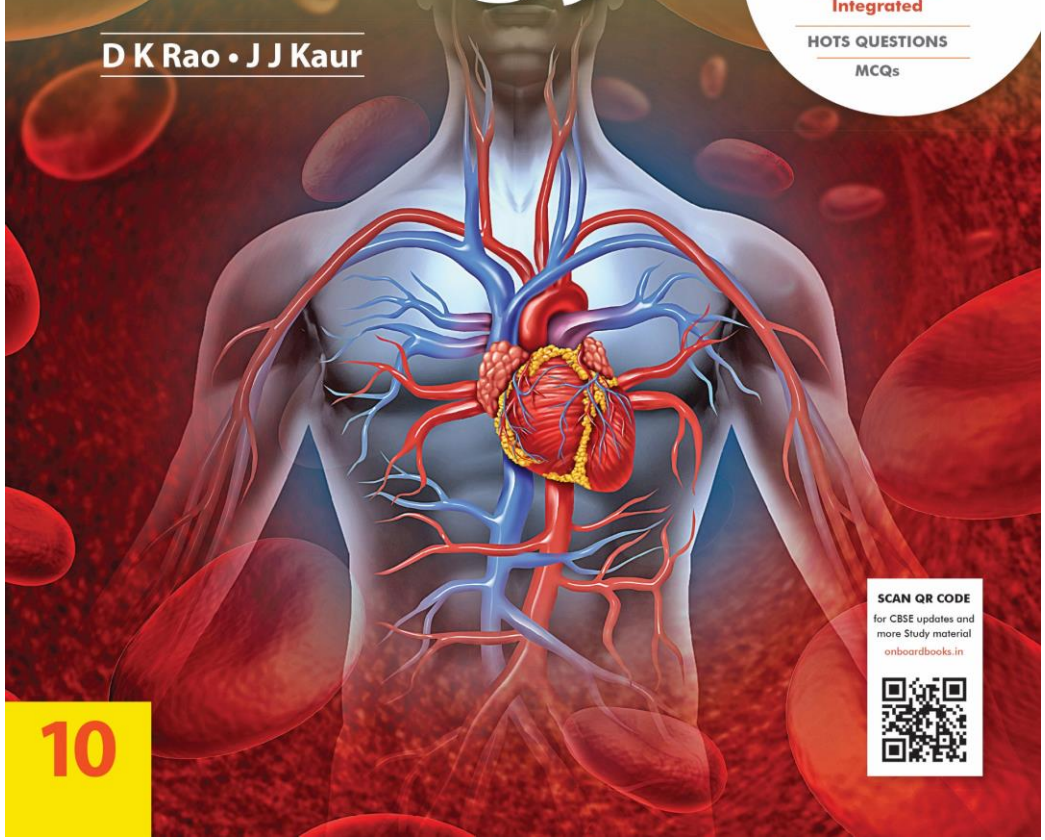

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CBSE
Living Science
Biology

Class 10

Chapter 6 Our Environment

LEARNING OBJECTIVES

Waste Material Affecting the Environment

- ❖ Biodegradable and non-biodegradable waste

Ecosystem

- ❖ Components of an ecosystem

Food Chain and Food Web

- ❖ Trophic Levels
- ❖ Flow of Energy in an Ecosystem
- ❖ Characteristics of energy transfer
- ❖ The ten per cent law
- ❖ Significance of food chains

How do Toxic Chemicals Enter Our Food Chain?

- ❖ Bio-magnification

Ozone Layer Depletion

- ❖ Causes of ozone layer depletion
- ❖ Effects of ozone layer depletion

Managing the Garbage We Produce

Environment and its Components

Environment can be defined as the physical and biological world where we live.

Environment has two major components:

Physical surroundings: These include the **abiotic environment**, that is, the air that we breathe, the water that we drink and the soil (land) on which we live.

Living organisms: These constitute the **biotic environment**, i.e. plants and animals, including humans, and microorganisms like bacteria and fungi.

How Does Waste Material Affect the Environment?

Biodegradable and non-biodegradable waste

Waste materials can be broadly classified into two types – biodegradable waste materials and non-biodegradable waste materials.

Biodegradable waste materials

The waste materials that can be broken down or decomposed into simple substances in nature by the action of microorganisms (bacteria, fungi, etc.) in due course of time are called biodegradable waste materials.

For example, dead plants and animals, animal excreta (cattle dung, urine), leather goods, tea leaves, wool, paper, plant parts, hay and wood, cotton clothes, cardboard, seeds, grains and compost (manure made from decayed plants and vegetable stuff) are all biodegradable substances.

Non-biodegradable waste materials

The waste materials that cannot be decomposed to simple non-poisonous substances in nature or degrade at very slow rate are called non-biodegradable waste materials.

For example, plastic, polythene bags, synthetic fibres, glass objects, metal articles like aluminium cans, silver foils, certain detergents, fertilizers and pesticides like DDT and radioactive wastes are non-biodegradable substances. The non-biodegradable substances cannot be decayed or decomposed by microorganisms like bacteria.

Ecosystem

Ecosystem is a structural and functional unit of the biosphere consisting of biotic components (living beings) **and the abiotic components** (physical environment like temperature, rainfall, soil, air and mineral nutrients) **which interact with each other and maintain a balance in nature**. Thus, all the interacting organisms in an area together with the non-living components of the environment constitute an ecosystem. **In an ecosystem, energy and matter are continuously exchanged between living and non-living components.**

Components of an Ecosystem

Every ecosystem has two main components –

1. Abiotic (non-living) components

These are non-living components of an ecosystem (also called **abiotic factors**) and include physical factors like soil, water, air, sunlight, temperature, humidity, moisture, rainfall, etc. These factors affect the distribution of the organisms.

Biotic (living) components

The biotic community of an ecosystem comprise living organisms like plants, animals and microbes that fall into three groups.

1. Producers (autotrophs): All green plants and certain bacteria which are able to synthesize organic food from inorganic substances in the presence of chlorophyll and sunlight are called the producers. They convert solar energy into chemical energy.

2. Consumers (heterotrophs): They are the organisms which feed on organic food prepared by autotrophs directly or on other consumers. Consumers are differentiated into three broad categories –

Herbivores obtain their food and energy directly from green plants . For example, rabbit, mouse, squirrel, grasshopper, goat and cattle.

Carnivores ingest other animals. For example, peacock, lion, tiger, etc.

Omnivores are those animals which can feed on both plants and animals. For example, cockroach, humans and bear.

Parasites are organism that lives in or on other organisms and gets its nourishment from its host. For example, plasmodium.

Note: Refer to Table 6.2 for the main differences between producers and consumers.

3. Decomposers: They are micro-organisms which feed on dead organisms and organic wastes, for example, certain bacteria and fungi. They break down the complex organic compounds present in the dead organisms into simpler inorganic substances.

Importance of decomposers

- They help in decomposing the dead bodies of animals and plants, thereby acting as cleansing agents of the environment.
- They help in putting back the nutrient elements (present in dead plants and animals) into the soil, air and water for reuse by the producers. Thus, they maintain the fertility of the soil.
- Decomposers help in recycling the materials in the biosphere so that the process of life may go on and on like an unending chain.

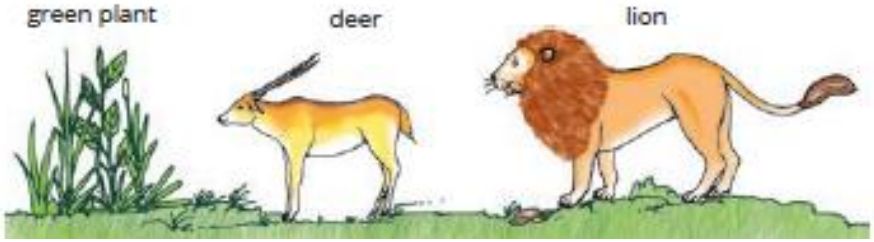
Food Chain and Food Web

Food chain

Food chain is a sequential process in which one organism consumes another organism to transfer food energy. In a food chain, transfer of energy takes place in one direction only (unidirectional). All the food chains begin with green plants or grasses since green plants (autotrophs) are the source of all the food.

1. A food chain operating in a forest.

Green plant → Deer → Lion
(Producer) (Herbivore) (Carnivore)



A three-step food chain in a forest ecosystem

In this food chain, green plants represent the **producers** (first trophic level). They synthesize their own food by the process of photosynthesis. They are eaten up by deer, which represent the **herbivores**. Deer in turn are consumed by lions, the **carnivores** or the **secondary consumers**.

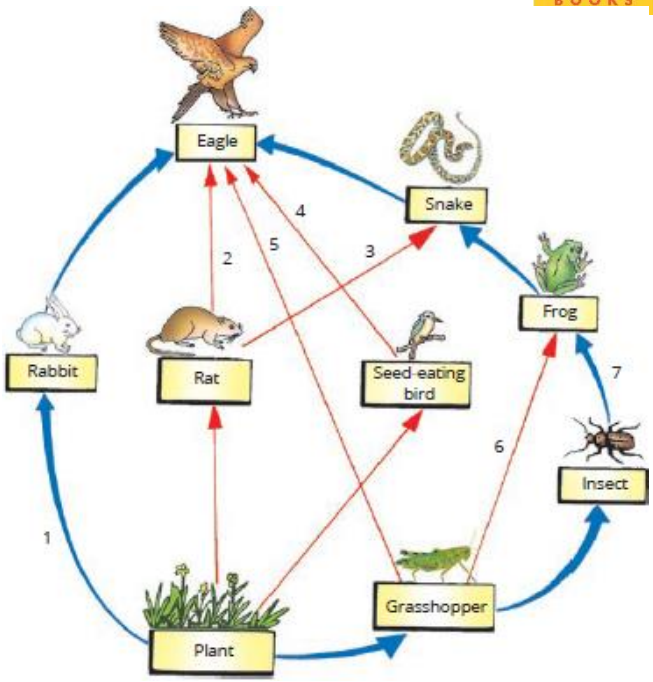
2. A food chain in a grassland which has five-levels is:

Green Plant → Insect → Frog → Snake → Eagle
(Producer) (Herbivore) (Carnivore) (Secondary carnivore) (Top carnivore)

A five-step food chain in a grassland ecosystem

Food web

The various food chains operating within an ecosystem or the biosphere cannot function in isolation. Many of these food chains are interconnected by organisms which are a part of more than one food chain. Thus, various food chains form a network with interconnections and linkages. The network of various food chains which are interconnected at various trophic levels is called a food web.



This food web has seven interconnected food chains. These are:

1. Plant → Rabbit → Eagle

2. Plant → Rat → Eagle

3. Plant → Rat → Snake → Eagle

4. Plant → Seed-eating bird → Eagle

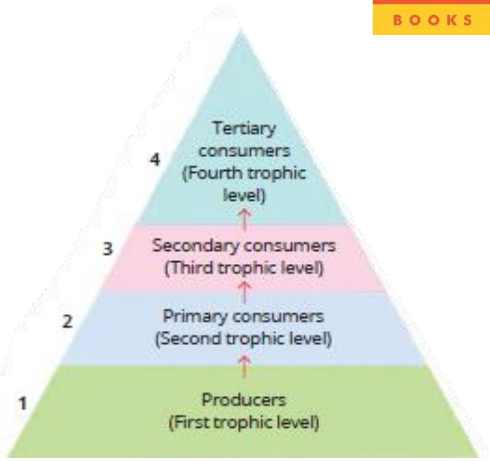
5. Plant → Grasshopper → Eagle

6. Plant → Grasshopper → Frog → Snake → Eagle

7. Plant → Grasshopper → Bigger Insect → Frog → Snake →Eagle

Trophic Levels

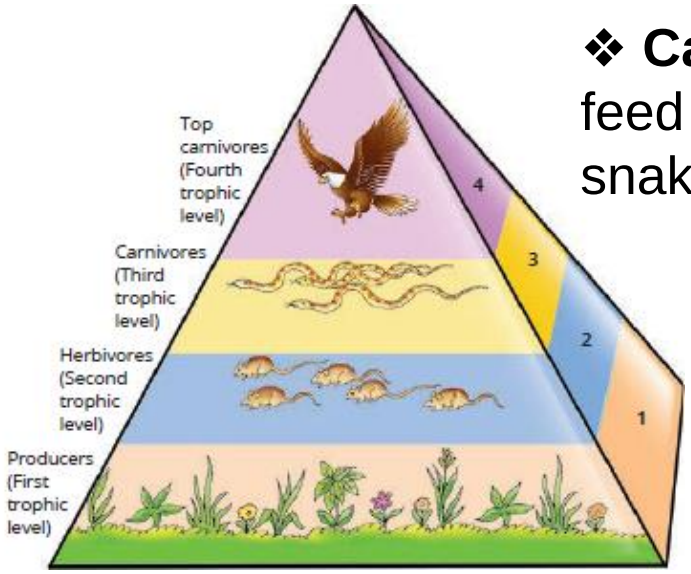
The various links or steps representing organisms in a food chain at which the transfer of food and energy takes place are **called trophic levels.** The various trophic levels are given below:



The various trophic levels in a food chain

❖ **The plants or the producers** which fix the solar energy and provide it for consumers constitute the first trophic level, e.g. green plants.

❖ **The herbivores or the primary consumers** form the second trophic level, e.g. rats, insects, rabbit, deer, goat, etc.



Pyramid of numbers showing various trophic levels in a food chain

❖ **Carnivores or the secondary consumers** which feed on herbivores make up the third trophic level, e.g. snakes, wall lizards, frogs, birds, small fish, etc .

❖ **Large carnivores or top carnivores or the tertiary consumers**, which feed on the small carnivores (third trophic level) **constitute the fourth trophic level**, e.g. eagle, tiger, lion, etc.

Flow of Energy in an Ecosystem

Green plants capture about 1% of the solar energy that falls on their leaves through the process of photosynthesis. A part of this trapped energy is used by plants in performing their metabolic activities and some energy is released as heat into the atmosphere. The remaining energy is **stored as chemical energy in plants in the form of photosynthetic products**.

When plants are eaten up by herbivores, the chemical energy stored in the plants is transferred to these animals. These animals (herbivores) utilize some of this energy for metabolic activities, some energy is released as heat and the remaining energy is stored.

The process of energy transfer is similarly repeated with carnivores, top carnivores and so on.

Characteristics of energy transfer

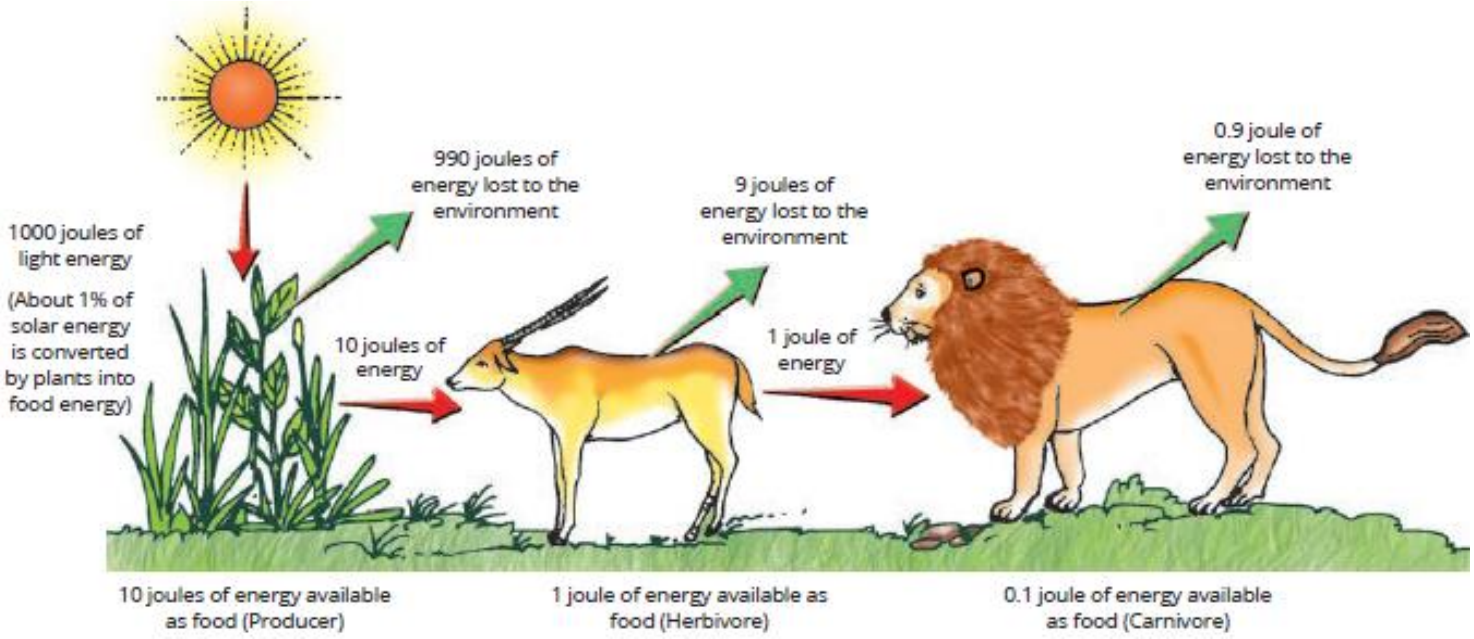
The following are the characteristics of energy transfer in the biosphere:

- Energy is supplied by the sun and it is not created in the biosphere. Energy is only converted from one form to another in the biosphere.
- There is a continuous transfer of energy from one trophic level to the next in a food chain. This flow of energy is unidirectional.

- At each trophic level, some of the energy is utilized by the organisms for their growth, reproduction and development.
- At each trophic level, some amount of energy is lost due to respiration and other metabolic activities which goes into the environment and remains unutilized.

The ten per cent law

According to the ten per cent law, only 10% of the total energy enters a particular trophic level of a consumer, and out of this, only 10% is available for transfer to the next trophic level.



Transfer of energy according to ten per cent law

Significance of food chains

- The food chains transfer energy and materials between various living components of an ecosystem or biosphere.
- The study of food chains helps in understanding food relationships and interactions among various organisms in an ecosystem.
- The food chains give dynamicity to an ecosystem or biosphere.

How Do Our Activities Affect the Ecosystem?

Due to human activities like indiscriminate cutting of forests, construction activities and pollution, the food chains get disturbed. This leads to imbalance in the functioning of ecosystem. For example, due to extensive hunting of lions in Rajasthan, the food chain got disturbed leading to increase in the population of herbivores. These herbivores fed on grass and due to overgrazing, most parts of Rajasthan were converted into desert.

How Do Toxic Chemicals Enter Our Food Chain?

Biomagnification: In food chains, movement of toxic chemicals like pesticides and weedicides takes place. These chemicals enter our body through food chain. Increase in the concentration of harmful chemical substances in the body of living organisms at each trophic level of a food chain is called biological magnification or biomagnification.

Ozone Layer Depletion

What is ozone layer?

An ozone molecule contains three oxygen atoms and is represented as O_3. It is a poisonous gas if inhaled. However, it forms a layer in the upper part of the atmosphere and absorbs harmful ultraviolet (UV) radiations from the sun. It is thus very important for life on Earth since it prevents harmful UV rays from the sun from reaching the earth.

What causes ozone layer depletion?

There are many substances that we use in our day-to-day life which cause ozone layer depletion. These substances are called **ozone depleting substances (ODS)**.

Chlorofluorocarbons (CFCs) are the main synthetic chemicals leading to ozone layer depletion. The CFCs are mainly used in fire-extinguishers, refrigerants (like in air conditioners) and aerosol sprays. CFCs when released in the air react with ozone gas and destroy it gradually.

What are the effects of ozone layer depletion?

In the upper atmosphere, ozone is like a cover that protects us by screening the dangerous UV radiations from the sun. Without ozone shield, there will be many ill effects on living organisms such as:

Diseases in human beings: UV radiations can cause diseases in human beings such as cataract, skin cancer, dimming of eyesight and immune system malfunctioning.

Mutation: The UV radiations may cause mutations.

How can we prevent the ozone layer depletion?

In 1987, the United Nations Environment Programme (UNEP) had an agreement to freeze CFC production at 1986 levels. At our individual level, we can stop the use of aerosol sprays that emit CFCs to prevent ozone layer depletion. It is now mandatory not to use CFCs in refrigerators throughout the world.

Managing the Garbage We Produce

It is very important to dispose the waste we produce. This waste can be disposed by–recycling, composting, incineration, landfill and sewage treatment.

Most of the waste material of plastic, glass and metals can be recycled and remoulded.
The biodegradable waste material can be composted to make manure. The municipal bodies collect and dispose waste by incineration or dumping it into landfills.

Disposable cups in trains

Earlier, tea used to be served in plastic cups in trains. This, on one hand had health hazards, and on the other, their disposal was a challenge. Therefore, the Government decided to replace these plastic cups with *kulhads* (earthen pots). However, preparing/ manufacturing *kulhads* on such a large scale was very difficult and it would also result in the loss of fertile topsoil. The Government has decided to use paper cups for serving tea in trains. These paper cups are biodegradable and can be disposed of easily.

SUMMARY...

- The physical and biological world in which we live is called our environment. It has two major components – physical surroundings and living organisms.
- Materials that can be broken down into non-poisonous substances by the action of microorganisms or natural process are called biodegradable substances.
- Materials that cannot be decomposed to non-poisonous substances in nature by the action of microorganisms are called non-biodegradable substances.
- Ecosystem is a structural and functional unit of the biosphere. It is a relatively self-contained and distinct community of organisms (plants and animals) and their environment.
- Plants are producers. Animals that feed on plants are consumers.
- Decomposers are saprophytic microorganisms, i.e. certain bacteria and fungi. They break down the complex wastes of dead organisms into simpler substances.
- The sequence of the living organisms in a community in which one organism consumes another organism to transfer energy is called a food chain.

❖ The network of various food chains interconnected at various levels is called a food web.

❖ The various links or steps representing organisms in a food chain in which the transfer of food and energy takes place are called trophic levels.

❖ Green plants capture about 1% of the solar energy available on the earth through the biochemical process of photosynthesis.

❖ The increase in concentration of harmful chemical substances in the body of living organisms at each trophic level of a food chain is called biomagnification.

❖ Chlorofluorocarbons (CFCs) are chemical substances that cause ozone layer depletion.

❖ Disposing of waste by recycling, composting, incinerating, land filling and sewage treatment is very important for keeping environment clean and healthy.

THANK YOU