

GENERAL SCIENCE

8

Based on Single National Curriculum 2022



Punjab Curriculum and Textbook Board, Lahore

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

(In the Name of Allah, the Most Compassionate, the Most Merciful.)

GENERAL SCIENCE

8

Web Version of PCTB Textbook
Not for Sale

Based on Single National Curriculum 2022

ONE NATION, ONE CURRICULUM



**PUNJAB CURRICULUM AND
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Experimental Edition

Edition

1st

Impression

1st

Date of Printing

No. of Copies



Preface

This book has been designed to maintain the pace of gradual development of scientific concepts as determined by Single National Curriculum 2022 for General Science VI to VIII.

Before printing, it was thoroughly reviewed by a committee of well-known experts to seek its valuable recommendations which have been duly incorporated in the book. The review committee found it aligned with the Single National Curriculum 2022 and recommended it for onward submission for approval from the Board of Government of the Punjab Curriculum and Textbook Board. The key characteristics of the book are as under:

- The subject matter is fully equipped with specific illustrations for strengthening the concept.
- Facts and principles are explained succinctly and clearly.
- For developing an inquiry based approach and skills of practical work in the students, science activities have been included in each chapter of the book.
- Tags of interesting information, mini-exercises, the brain teasers and additional information under the captions of “Do You Know?” have been inserted at proper places to steer students through the concepts.

We wish that this book proves to be an ideal choice for the students looking for a supplement to promote their potentials in the fields of Biology, Chemistry, Physics, Geography and Space Science. As there is always a room for improvement, we cordially invite the valuable suggestions for improvement of the text of this book.

(Authors)

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Why the temperature of the Earth is increasing day by day?

How does the balance of an ecosystem disturb?

What are the solutions of environmental problems?

01

Ecology

Students' Learning Outcomes

After studying this chapter, students will be able to:

- Describe the role of living things in cycling oxygen and carbon through an ecosystem, citing the processes of respiration, photosynthesis and combustion.
- Relate how oxygen and carbon cycles are complementary processes that bring balance and symmetry to life on the Earth.
- Describe global warming and explain how threats to the carbon-oxygen balance such as overpopulation, reliance on fossil fuels, and deforestation are contributing to global warming and climate change.
- Describe how energy flows from producers to consumers and how only part of the energy flows from one level of the pyramid to the next.
- Draw a food web diagram to illustrate the food relationships between organisms.
- Describe and illustrate through examples key ecological relationships between organisms, including competition, predation and symbiosis.
- Predict how changes in an ecosystem (e.g., changes in the water supply, the introduction of a new population, hunting, migration) can affect available resources, and thus the balance among populations.
- Hypothesize what would happen in the ecosystem if the population of one of the participants in different ecological relationships is affected.
- Explain the ways in which human behavior (e.g., Planting forests, reducing air and water pollution, protecting endangered species) can have positive effects on the local environment.

The environment in our surrounding has both living and non-living things. Living things of an environment are termed as its **biotic component**, whereas, non-living things of the environment are termed as its **abiotic component**. Biotic and abiotic components of an environment are interrelated. The study of relationships between the biotic and abiotic components of an environment is called **ecology**. The system of interaction and interdependence between biotic and abiotic components of the environment is called **ecosystem**.

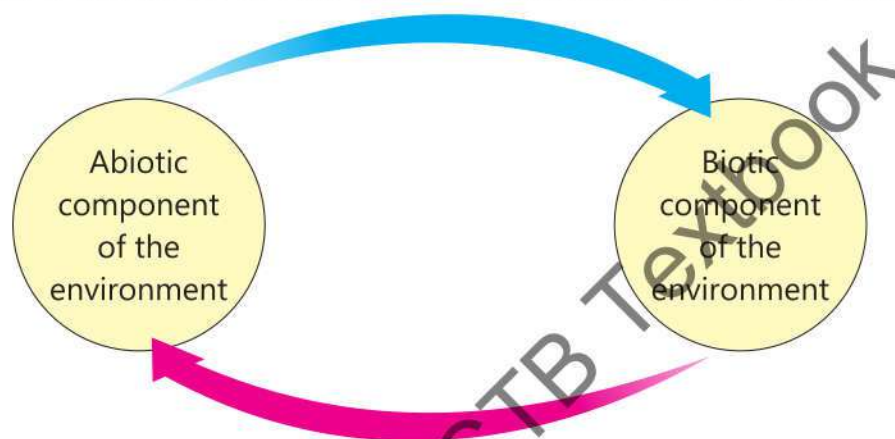


Figure 1.1 Natural cycles

In an ecosystem, abiotic matters like carbon dioxide and water, etc., are used by plants which trap the sunlight energy and convert them into food. Transport of energy to different organisms of biotic component as food chain is one of the most important functions of an ecosystem. On decay of dead bodies of the organisms, abiotic matters fixed in biotic component are released back into abiotic component. In this way, an ecosystem facilitates the transport of different materials in cyclic way and maintains the natural balance (Figure 1.1).

1.1 CARBON AND OXYGEN CYCLE

Carbon and oxygen are two elements that are essential to life. They are naturally present in the atmosphere in the form of carbon dioxide and oxygen gases. They constantly circulate between the environment and living organisms in a cyclic way. When plants prepare food in photosynthesis, they take in carbon from the atmosphere in the form of carbon dioxide (Figure 1.2). In this process, they also release oxygen gas to the atmosphere.

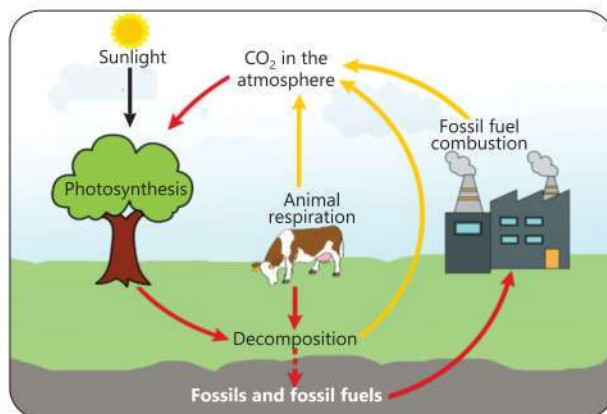


Figure 1.2 Carbon cycle

All animals and plants respire to get energy. During respiration they take in oxygen from the atmosphere and release carbon dioxide to atmosphere (Figure 1.3).

Similarly, during decomposition and combustion of biomass (matter of dead bodies), the oxygen gas present in atmosphere is used and the carbon of biomass is released into the atmosphere in the form of carbon dioxide.

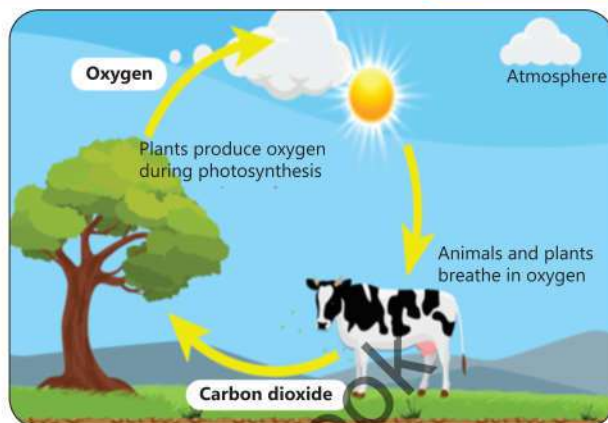


Figure 1.3 Oxygen cycle



Brain Teaser

What are fossils and fossil fuels? How are they important?

1.2 ENERGY FLOW IN THE ECOSYSTEM

We know that organisms need energy for their life activities. They get energy from food. In an ecosystem, plants produce food during **photosynthesis** and are thus termed as **producers**. During photosynthesis, plants trap energy from sunlight and store it as chemical energy in food. Animals consume the food prepared by plants and are thus termed as consumers. Animals that eat plants directly are called **primary consumers** or **herbivores**. Animals that eat other animals are called **secondary consumers** and **tertiary consumers** or **carnivores**. Human and some animals eat both plants as well as meat of animals and are thus called **omnivores**. During this process of eating and being eaten, sunlight energy stored in plants food as chemical energy is transferred from producers to different levels of consumers (Figure 1.4).

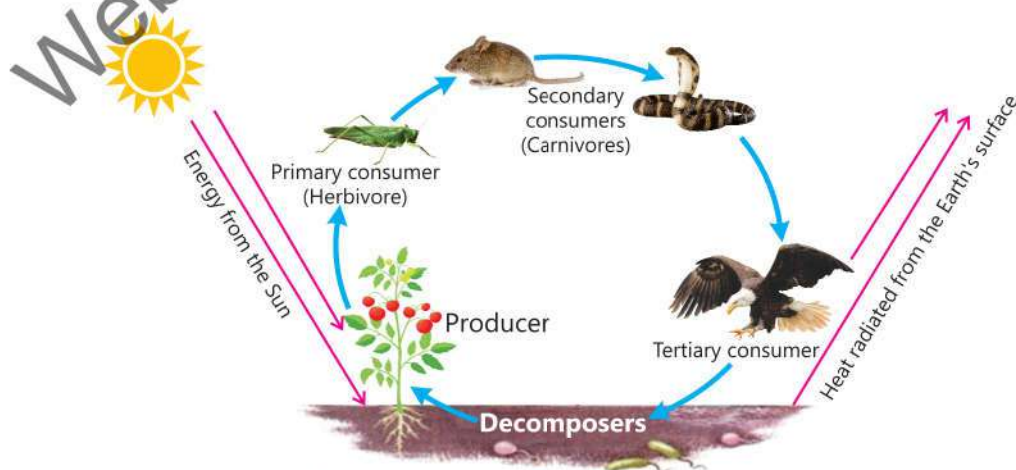


Figure 1.4 Energy flow in an ecosystem

1.2.1 Food Chain and Food Web

Production of food and the feeding relationship among organisms at different levels form a chain called **food chain**. A food chain starts at the producers level and is followed by herbivores level (primary consumers). Then, it continues to the carnivores, (secondary consumers and tertiary consumers) (Figure 1.5). At the end, the dead bodies of the organisms are consumed by **decomposers**.

In reality, food chains are not simple because animals eat a variety of organisms. A fox, for example, does not feed only on rabbits but also takes rats and squirrels in its diet. Similarly owl and hawk may also take different organisms as their food.

These relationships or interactions between different organisms can be expressed more accurately as a food web shown in Figure 1.6 where all animals feed in more than one food chain, these food chains are joined together to make a **food web**.

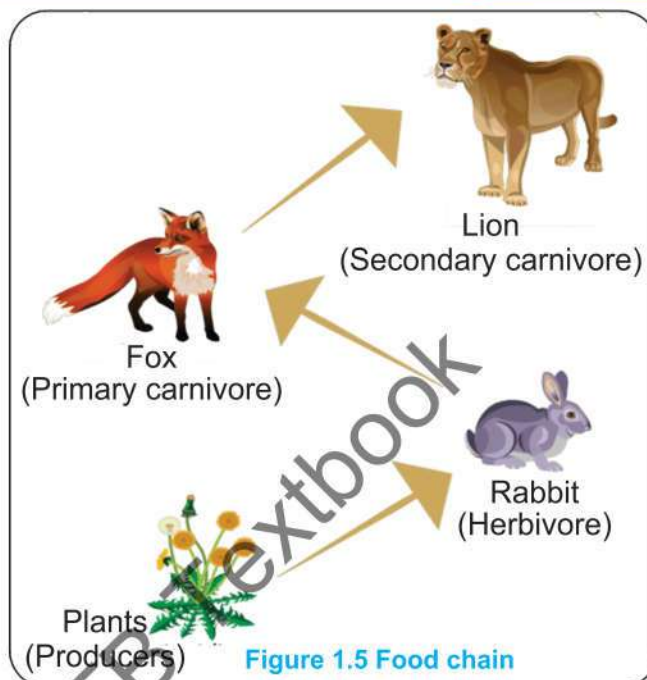


Figure 1.5 Food chain

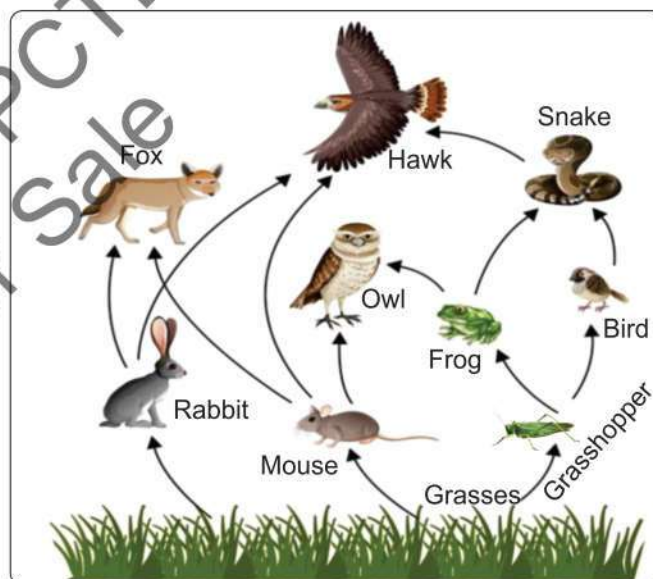


Figure 1.6 Food Web



Brain Teaser

What would happen if decomposers are vanished from the face of the Earth?

1.2.2 Ecological Pyramid

The different feeding levels of organisms in an ecosystem are called trophic levels e.g., producers, herbivores, primary carnivores etc. Biologists express the trophic relationships by the diagrams that take the shape of pyramids. These diagram are thus called ecological (or biological) pyramids (Figure 1.7). At the base of the pyramid are producers or green plants. The upper levels are occupied by primary, secondary and tertiary consumers in ascending order. Usually primary consumers are herbivores and the rest are carnivores (or omnivores).

The ecological pyramids are usually based on number and weight of organisms at each trophic level. Both the number and weight of organisms decrease from base to the top of pyramid. How can we explain the decrease in number or weight? It has been estimated that in an ecological pyramid, the herbivores are generally one tenth of the weight of the producers and the carnivores are one tenth of the weight of the herbivores. For example plants weighing 100,000 kg would be enough to feed small herbivore animals weighing 10,000 kg. Similarly, 10,000 kg of herbivores would support primary carnivore weighing 1000 kg. These carnivores would be enough to feed 100 kg weight of secondary carnivore.

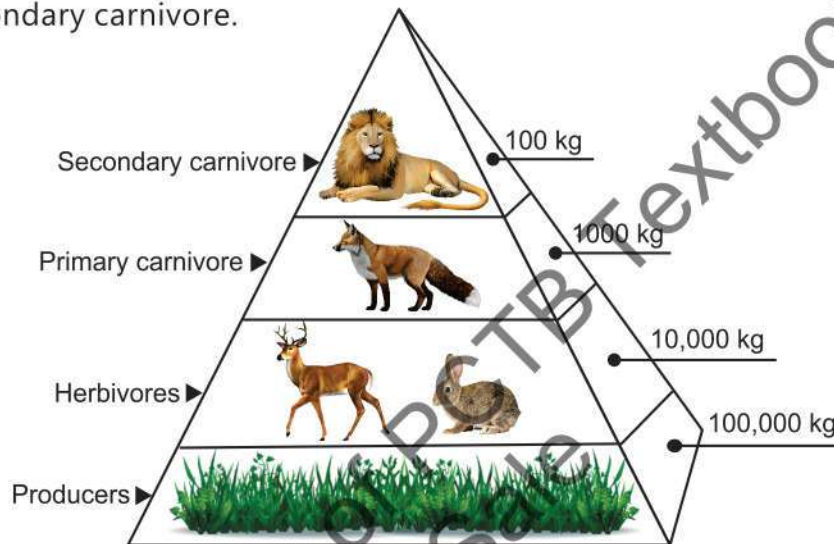


Figure 1.7 Ecological Pyramid

1.2.3 Ecological Interdependence

Organisms in ecological communities interact with one another in three major ways which are as follows:

Predation

Consumers that actively hunt other organisms are called **predators**. The organism upon which a predator feeds is called **prey**. A frog that eats an insect is a predator. The insect is the prey. The frog itself is prey to other organisms such as snakes and storks. The predators in turn are prey to larger carnivores. The size of predator and prey populations are closely linked. A large prey population supports more predators. If a prey population grows or shrinks, the number of predators may also change as well.



Figure 1.8 Predation

Competition

Competition occurs when two or more individuals or populations attempt to use the same resource of environment e.g., food, water, shelter, or sunlight. We know that every environment has limited amount of resources. When one or more individuals or population use the same resources, they become less available to others. Competition can occur among individuals within a population, the intraspecific competition, or between different species, the interspecific competition.



Figure 1.9 Competition

Symbiosis

A relationship where two species live together closely is called **symbiosis**. The type of symbiosis in which one species gets benefit while the other species is neither benefited nor harmed is called **commensalism**. For example, lichens and small plants grow on the trunks of big trees. They get nutrients from tree while the tree gets no harm or benefit. A symbiotic relationship in which both species get benefit is called **mutualism**. An example is the relationship between flowers and the insects that pollinate them. The flower provides food to the insects in the form of nectar. In return, the insects help in the cross pollination of flower.



Figure 1.10 Commensalism



Figure 1.11 Mutualism

1.2.4 Ecological Imbalance

Introduction of new species in an ecosystem, overhunting, migration, etc., are the factors which are disturbing the natural balance of ecosystem. This is called ecological imbalance.

Introduction of a new species

The entering of a foreign species into any area can imbalance the natural ecosystem. For example in the Philippines, some species such as toad and golden snail were introduced. The population of these species went uncontrollable because of lack of natural enemies.



Figure 1.12 Introduction of new species

Overhunting

It is defined as the relentless chase for wild or game animals to kill or catch them for economic or personal gains or food. Excessive hunting can cause extinction of many species. Overhunting of one animal species causes an abundance of the other, hence leading to an imbalance in the natural ecosystem and the food chain.



Figure 1.13 Overhunting

Shortage of water supply

Due to overpopulation and our constant need for factory-made products, the use of water from water bodies has been increased. This results in loss of freshwater in water bodies, i.e., rivers, canals, lakes, etc. Pollution in water bodies is not only limited to the factory waste. More domestic use of water, due to overpopulation, also contributes to the pollution and loss of freshwater in water bodies. Climate changes also affect the water supply in our environment through flood or droughts.



Figure 1.14 Factories discharging wastes in the water bodies

Migration

Migration is the movement of organisms from one place to another. This movement changes the population of a place. The migration usually takes place for search of food, water and shelter e.g birds migrate for the search of food.



Figure 1.15 Migration

1.3 ENVIRONMENTAL PROBLEMS

1.3.1 Global Warming

Some gases present in the atmosphere, e.g., carbon dioxide (CO_2), methane (CH_4), oxides of nitrogen (NO_2), water vapours, etc., trap a part of the heat reflected by the Earth causing increase in the atmospheric temperature (Figure 1.16). These gases are called **greenhouse gases** and the phenomenon is called **greenhouse effect**. Due to human activities like burning of fuel, etc., the amount of greenhouse gases is increased in the atmosphere. This speeds up the greenhouse effect. The increasing rate of greenhouse effect is increasing the average temperature of the Earth. As a result, the Earth is getting warmer. This is called **global warming**. Due to global warming, the ice in the polar regions and at the mountains melts at a greater rate. This leads to rise in the level of sea water which creates floods in low lying coastal areas. The climate of many regions of the world is also changing due to global warming. The global warming is thus a threat to the life on the Earth (Figure 1.17).

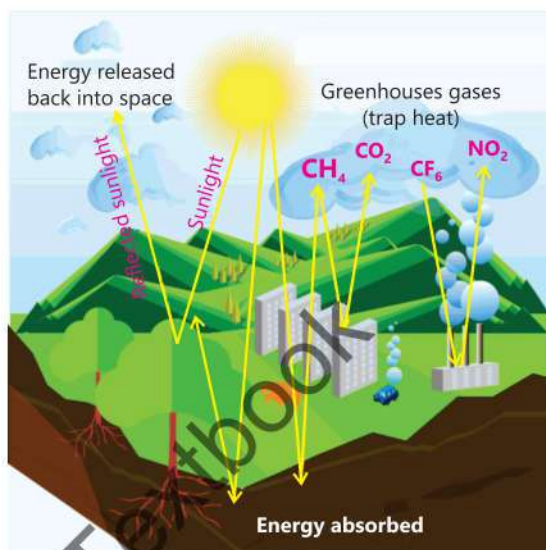


Figure 1.16 Greenhouse effect

Do You know?

Ozone layer in the upper atmosphere of the Earth stops the ultraviolet rays coming from the Sun to the Earth.



Figure 1.17 Effects of global warming

1.3.2 Factors affecting Global Warming

Burning of fossil fuels

When fossil fuels are burnt to run vehicles and industries, they emit many greenhouse gases like carbon oxide which cause global warming. The burning of fossil fuels also releases poisonous substances in the air. The poisonous and harmful substances which make the air unfavorable for life are called **air pollutants**. One of the air pollutants is carbon monoxide. It affects the human organ systems badly and causes headache, brain damage and respiratory problems. Sulphur dioxide and oxides of nitrogen dissolve in rain water and cause acid rain. Exposure to sulphur dioxide can cause breathing difficulties, pneumonia, lung cancer, etc.



Figure 1.18 Burning of fossil fuel

Deforestation

Destruction of forests as a result of human activities is called **deforestation**. Deforestation has many adverse effects on the environment. It changes weather and climate. Roots of trees hold the soil. Cutting of trees leads to soil erosion and fertile part of the soil is lost through this process. When forests are cut, rate of evaporation is reduced which results in less rain. Deforestation decreases the carbon dioxide consumption by plants increasing its amount in the environment. This leads to the increased greenhouse effect and global warming.



Figure 1.19 Deforestation

Do You know?

Changa Manga is a man-made forest in Pakistan. It is found in District Kasur in the Punjab.

Overpopulation

When the population of an organism (e.g., humans) becomes larger than the capacity of environment, it is called overpopulation. More people demand for more oil, coal, gas, and other energy sources. When more and more fossil fuels are used, more greenhouse gases and other pollutants are released into the environment. In this way, overpopulation results in more global warming.



Mini Exercise

Explain the effects of global warming on the life on the Earth.

1.4 SOLUTIONS OF ENVIRONMENTAL PROBLEMS

The Earth is the only planet in our Solar System where life exists. Pollutants are harmful to the life on the Earth. We should keep the Earth's environment clean and healthy. Here are some of the solutions of environmental problems.

1.4.1 Reducing pollution

We can take many steps to reduce pollution. Domestic trash and other solid wastes should not be dumped on open places. Instead of personal cars, public transport should be used for travel. Sulphur and lead free fuel should be used in vehicles. Factories and industries should be shifted away from the populated areas. Acidic industrial exhaust gases must be neutralized before releasing into the air. Engines of the vehicles should be tuned properly. Chlorofluorocarbons (CFCs) free products should be used. 4R strategies of Refuse-Reduce-Reuse-Recycle for the conservation of resources should be adopted. Trees should be grown along the road sides.

1.4.2 Plantation

There are many benefits of plants. Planting more trees can reduce the level of air pollution as plants absorb pollutants. It also maintains the temperature of an area at a lower level than an area that does not have trees. They are also the habitat for birds and many other animals. Trees are also a source of fruits and flowers. Each and everyone of us have to plant trees and enhance the quality of life.



Figure 1.20 Reducing Pollution



Figure 1.21 Replantation

1.4.3 Protection of endangered species

Human activities cause rapid and widespread environmental changes that affect living things. Many species of animals and plants are at risk of extinction. Such species are called **endangered species**. One of the major causes of species becoming endangered is habitat loss. Humans cut down trees in forests for harvesting. They clear forests or drain wetlands to use the land for agriculture, mining, and settlement. Similarly, pollution, global warming, excessive hunting are also the causes of species becoming endangered. Some of the endangered species of Pakistan are snow leopard, indus river dolphin, markhor, etc.



Snow leopard



Indus river dolphin



Markhor

Figure 1.22 Endangered species of Pakistan

Governments develop plans to protect the endangered species. Such plans include reducing deforestation, setting aside nature reserves, reducing pollution, and protecting natural habitats. The hunting and trade of endangered species is also banned. Moreover, governments make plans to take endangered species into "protective custody" outside their natural habitats. For example, animals may be kept in zoos.

Activity 1.1

Trace, colour and write below how the activities of the children are keeping environment clean and healthy.

a.



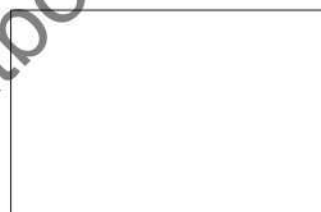
b.



Activity 1.2

Use internet or any other source to find three more pictures of endangered species and paste them in the given boxes.

c.



KEY POINTS

- Carbon and oxygen cycles are the processes in which these minerals circulate between the organisms and the environment.
- Organisms need energy for their life activities.
- The different feeding levels of organism in an ecosystem are called trophic levels.
- The ecological pyramids are usually based on number and weight of organisms at each trophic level.
- The feeding relationship among organisms at different trophic levels form a chain called the food chain.
- Consumers that actively hunt other organisms are called predators.
- Competition occurs when two or more individuals or populations attempt to use the same resource of environment e.g., food, water, shelter, or sunlight.
- A relationship where two species live together closely is called symbiosis.
- Introduction of new species, over hunting, change in water supply and migration are some of the factors which can cause ecological imbalance.
- The increasing rate of greenhouse effect and ozone depletion is increasing the average temperature of the Earth. As a result, the Earth globe is getting warmer. This is called global warming.

KEY POINTS

- The poisonous and harmful substances which make the air unfavorable for life are called air pollutants.
- Burning of fossil fuels, deforestation and overpopulation are factors which are increasing global warming.
- Many environmental problems can be solved by reducing pollution, replantation and protecting endangered species.

QUESTIONS

1. Encircle the correct option.

- (i) The phenomenon which does not lead to global warming:
(a) greenhouse effect (b) ozone depletion
(c) deforestation (d) photosynthesis
- (ii) The feeding level of an organism in an ecosystem is called _____.
(a) tropic level (b) secession level
(c) food chain (d) food Web
- (iii) The graphical representation of trophic relationship of organisms in an ecosystem is called _____.
(a) food chain (b) trophic level
(c) ecological pyramid (d) predation
- (iv) All the food chains are joined together to form _____.
(a) ecological pyramid (b) food web
(c) tropical level (d) none of these
- (v) The energy of the Sun is trapped as chemical energy by _____.
(a) producers (b) primary consumers
(c) secondary consumers (d) tertiary consumers
- (vi) Consumers that actively hunt other organisms are called _____.
(a) prey (b) predator
(c) symbiont (d) competitor
- (vii) A relationship where two species live together closely is called _____.
(a) predation (b) symbiosis
(c) competition (d) none of these
- (viii) We can solve environmental problems by:
(a) reducing pollution (b) plantation
(c) protection of endangered species (d) all of these

(ix) Ecological imbalance is caused by:

- (a) migration
- (b) overhunting
- (c) over population
- (d) all of these

2. Write short answers.

- (i) What are ecological pyramids?
- (ii) What is predation?
- (iii) Differentiate between:
 - (a) oxygen and carbon cycle
 - (b) food chain and food web
- (iv) Write any one of the solution of environmental problems.
- (v) Name some of the factors which can cause ecological imbalance.

3. Constructed response questions

- (i) How carbon and oxygen cycles are helpful for the environment?
- (ii) Is the Sun the main source of energy for life on the Earth? Explain.
- (iii) What would be the effect of overhunting?

4. Investigate

- (i) What would happen if we will not work to reduce global warming?
- (ii) Why do the producers occupy the base of the pyramid?
- (iii) Hypothesize what would happen in the ecosystem if the population of one of the species is affected.

Project

Grow a plant in an earthen pot.

Materials

Earthen pot, soil, cattle manure, seasonal plant seeds

Procedure

1. Take an earthen pot.
2. Fill it with soil.
3. Mix small quantity of cattle manure in the soil.
4. Sow a few seasonal plant seeds into the soil in the earthen pot.
5. Sprinkle water on the soil.
6. Place the pot where it can get access to sunlight.
7. After 2 weeks, observe the small seedling grown in the earthen pot.



Write how this project will be helpful in reducing the pollution.
