

Energy Flow in an Ecosystem

Exercises

Q. 1. Complete the following table (Carefully study the carbon, oxygen and nitrogen cycles).

Biogeochemical cycles	Biotic processes	Abiotic processes
Carbon cycle		
Oxygen cycle		
Nitrogen cycle		

Answer :

Biogeochemical cycles	Biotic processes	Abiotic processes
Carbon cycle	Photosynthesis, respiration, and decomposition	The burning of fossil fuels,
Oxygen cycle	Respiration, photosynthesis	Combustion
Nitrogen cycle	Biological nitrogen fixation, nitrification, denitrification	Nitrogen fixation by lightning

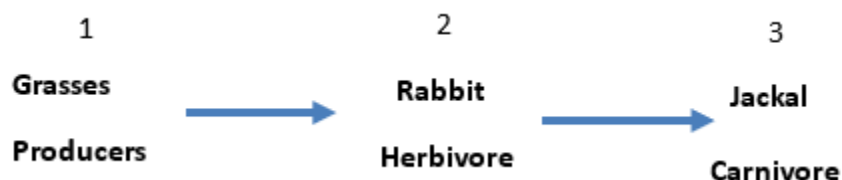
Q. 2. Correct and rewrite the following statements and justify your corrections.

A. Carnivores occupy the second trophic level in the food chain.

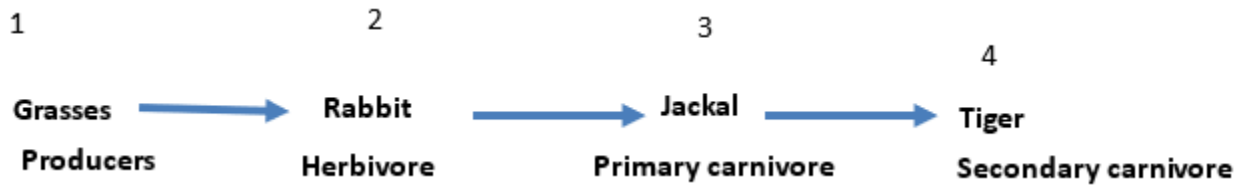
B. The flow of nutrients in an ecosystem is considered to be a 'one way' transport.

C. Plants in an ecosystem are called primary consumers.

Answer : A. **Correct Statement:** Carnivores occupy the third or top trophic level. Its depend on the nature of the food chain look at the examples:



In the above food, chain carnivore occupies top trophic level.



In the above food chain carnivores occupies third and top trophic levels.

B. Correct Statement: The flow of energy in an ecosystem is considered to be a 'one way' transport.

Explanation:

Sun is the only source of energy in the ecosystem. The energy in the ecosystem is flowed only in one direction. The energy from the sun is used by the plants to make food through photosynthesis. The energy from plants is then passed on from one organism to another in a food chain and it never returns to the sun. Thus, energy moves in one way that is from Sun to the plants, then to herbivores and then to carnivores.

C. Correct Statement: Plants in an ecosystem are called producers.

Explanation: Using the sunlight, green plants make food for themselves. Other organisms cannot make their food and depend on green plants for food. Therefore, green plants are the producers of food.

Q. 3. Give reasons.

A. Energy flow through an ecosystem is 'one way'.

B. Equilibrium is necessary in the various bio-geo-chemical cycles.

C. Flow of nutrients through an ecosystem is cyclic.

Answer : A. Sun is the only source of energy in the ecosystem. The energy in the ecosystem flows only in one direction. The energy from the sun is used by the plants to make food through photosynthesis. The energy from plants is then passed on from one organism to another in a food chain and it never returns to the sun. Thus, energy moves in one way that is from Sun to the plants, then to herbivores and then to carnivores.

B. A biogeochemical cycle is defined as cycling of materials (nutrients) through biotic components (living organisms) and abiotic components (non-living things such as soil, water). Most important biogeochemical cycles are the carbon cycle, nitrogen cycle, oxygen cycle, and the water cycle.

The producers of an ecosystem take up inorganic nutrients from their non-living environment. These nutrients changed into the biomass of the producers. Then the

biomass they are utilized by the different consumers and after death and decay of producers and consumers, the nutrients are returned to the environment. Thus, there is always a state of balance in the cycling of material in the ecosystem.

C. The green plants taking energy from the sun and inorganic nutrients such as water and carbon dioxide, nitrogen from their non-living environment involving different cycles. These nutrients changed into the biomass of the producers. Then the biomass of the producers is utilized by the different consumers. After death producers and consumers, decomposers such as bacteria and fungi break down dead body into nutrients. These nutrients are returned to the non-living environment. Thus, movement of nutrients (materials) in the ecosystem is in a cyclic manner.

Q. 4. Explain the following cycles in your own words with suitable diagrams.

A. Carbon cycle.

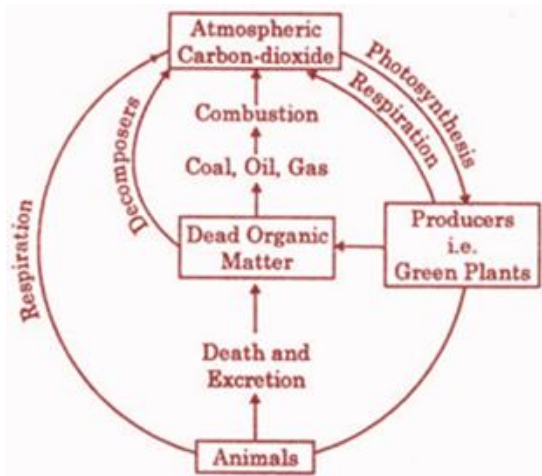
B. Nitrogen cycle.

C. Oxygen cycle.

Answer :

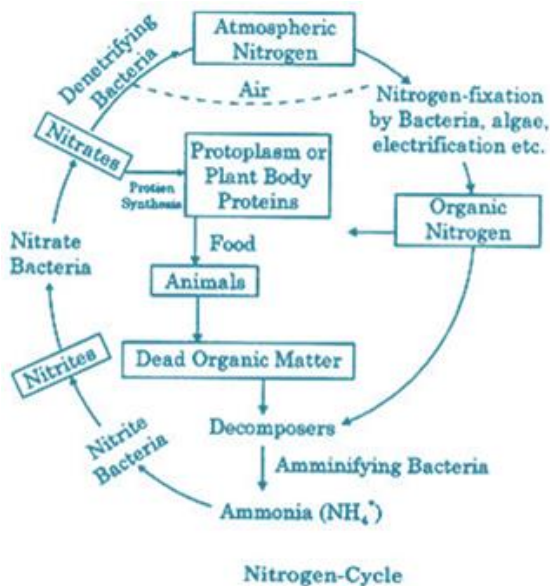
A. Carbon cycle:

- i. A major part of the carbon dioxide from the atmosphere enters into the living organisms through photosynthesis.
- ii. The green plants make the organic compounds (carbohydrates).
- iii. These compounds are passed from green plants to the consumers (herbivores and carnivores).
- iv. During respiration, plants and animals release carbon in the form of carbon dioxide back to the atmosphere.
- v. The dead bodies of plants and animals as well as the body wastes, which are also rich in carbon compounds, are broken down by decomposers such as bacteria and fungi to release carbon dioxide.
- vi. Carbon is also recycled during the burning of fossil fuels such as coal, petroleum products.



B. Nitrogen cycle:

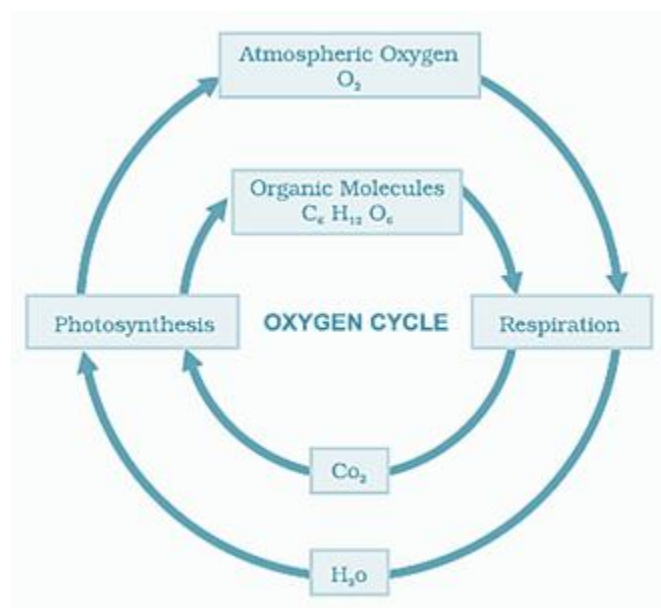
- i. Approximately 78% of air is nitrogen and it is a part of many molecules essential to life like proteins, nucleic acids (DNA and RNA), ATP, and some vitamins.
- ii. Neither plants nor animals can use atmospheric nitrogen. Plants or animals use nitrogen when it is fixed by nitrogen-fixing bacteria present in the root nodules of pulses plants.
- iii. These organisms convert fixed nitrogen into ammonia. After that other bacteria convert ammonia into nitrate, in a process called nitrification. It is two steps process. In the first step, *Nitrosomonas* convert ammonia into nitrite. In the second step, *Nitrobacter* converts nitrite into nitrate. This nitrate is then consumed by plants.
- iv. Thus, nitrate is the usable form of nitrogen. Through the process of denitrification by denitrifying bacteria converts nitrates nitrogen gas which is released into the atmosphere. This complete the cycle.



C. Oxygen cycle:

- i. Oxygen from the atmosphere is used up in three processes. These are combustion, respiration and in the formation of oxides of nitrogen.
- ii. Oxygen required for respiration in plants and animals enters the body directly from the surrounding medium (air and water).
- iii. Oxygen is returned to the atmosphere by photosynthesis.

During photosynthesis oxygen is released in the form of molecular oxygen as a by-product. Thus, the cycle is completed.



Q. 5. What would you do to help maintain the equilibrium in the various bio-geo-chemical cycles? Explain in brief.

Answer : i. Human activities on the large scale such as clearing forest or cutting of trees on large scale (deforestation), burning of fossil fuels, more use of chemical fertilizers, and pesticides.

ii. These activities disturb the biogeochemical processes, directly or indirectly.

iii. Some steps should be taken to maintain the biogeochemical equilibrium in the ecosystem such as:

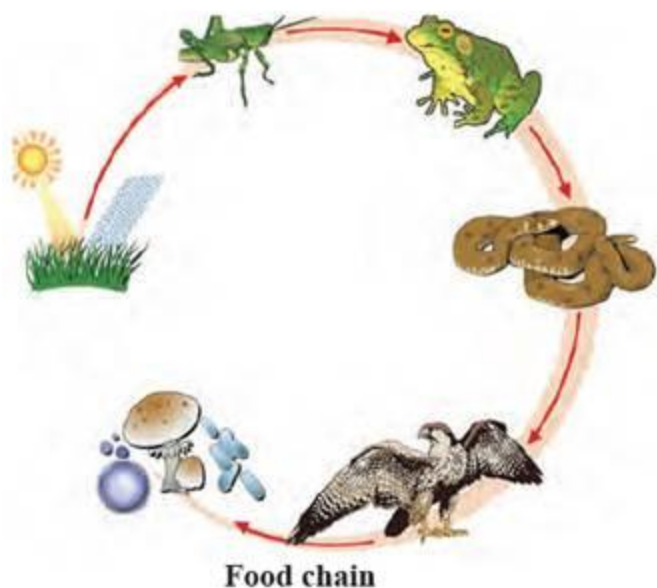
1. Plant more and more trees to maintain oxygen and carbon dioxide balance in nature.
2. Least use of chlorofluorocarbons.

3. Reduce vehicular pollution.

Q. 6. Explain in detail the inter-relationship between the food chain and food web.

Answer : A food chain is a series of organisms in which one organism eats another. Through food chain nutrients and energy pass from one organism to another through food. In a food chain, some organisms are producers and some are consumers. Each organism in a food chain occupies a specific trophic level.

Food web is a network of many interconnected food chains. Food web is a more realistic representation of food relationships in ecosystems.



Q. 7. State the different types of bio-geochemical cycles and explain the importance of those cycles.

Answer : Most important biogeochemical cycles are the carbon cycle, nitrogen cycle, oxygen cycle, and the water cycle.

Biogeochemical cycles do many functions at ecosystem level and ensure survival of various organisms including humans.

Some of the importance of biogeochemical cycles are given below:

I. Biogeochemical cycles change matter from one form to another. For example, humans use water in liquid form. Through the water cycle, water vapour is condensed to liquid and ice converted to liquid water.

II. Biogeochemical cycles transfer the molecules from one place to another. For example, another, the percentage of nitrogen is high in the atmosphere, but some of the atmospheric nitrogen is transferred to the soil through the nitrogen cycle.

III. Biogeochemical cycles link living organisms among themselves and with the non-living organisms. All organisms depend on one another and most especially, the biotic or living component and a biotic component of the ecosystem are linked by flow of nutrients.

Q. 8. Explain the following with suitable examples.

A. What type of changes occurs in the amount of energy during its transfer from plants to apex consumers?

B. What are the differences between flow of matter and of energy in an ecosystem? Why?

Answer : A. Primary consumers (herbivores) eat green plants. They take energy into their bodies. The herbivores use this energy for movement and reproduction. Some parts of the plant which was eaten cannot be digested by the herbivore; the energy in these parts of the plant passes out of the herbivore's body as waste. Some of the energy is used for growth and remains as organic matter in the herbivore's body. It is this energy which can be eaten by the secondary consumer. Only about 10% of the energy which the plant used for growth is taken into the body of the secondary consumers (carnivores).

As the energy is passed along the food chain much of the energy is either used or lost and only 10% of the energy is transferred to the next level.

B. Energy flow in the ecosystem is directional and is only in one direction because Sun is the ultimate source of energy. Sun energy is fixed into plants and from plants to the different consumers. Thus, energy enters into an ecosystem as sunlight, part of the energy is returned as heat and part is fixed as food (chemical compound) with help of inorganic materials. The chemical compounds are recycled in the ecosystem through different biogeochemical cycles. Therefore, in any ecosystem, energy flows in one direction and materials are recycled.

Q. 9. Prepare a model based on any natural cycle and present it in a science exhibition.

Answer : The water cycle is one of the important natural cycles. In the water cycle water goes into the atmosphere in the form of vapours from the water bodies such as ocean, rivers and comes on the earth as liquid water as rain.

Let's try to make a model of water cycle which may be useful in helping you to understand the process.

Materials required:

A large zip-lock plastic bag, water, food colour, masking tape and a thermometer

Procedure:

- i. Put about 250 ml of water into the bag. Add a drop or two of food colour.
- ii. Now close the bag and fixed the bag on the window which is receiving sunlight.
- iii. Hold the bulb of the thermometer against the bag for three minutes and then record the temperature.
- iv. Let the bag hang in the sun for 3-4 hours then observe the bag again.
- v. Look for any changes in the bag. Small water droplets will appear on the side of the bag and the level of water goes down.
- vi. Hold the bulb of the thermometer against the bag again for three minutes. Record the change in temperature.

Inference:

Small water droplets on the wall of the bag is due to evaporation and it will condensed to water. Thus, shows water cycle.

Q. 10. Write a paragraph on 'Balance in an Ecosystem'.

Answer : Ecosystem is the interaction between biotic (living) component such as plants, animals and other organisms and abiotic (non-living) components such as soil, water sunlight etc. An ecosystem is said to be balanced, when living and non -living components are in peace.

For example:

In an ecosystem, all the organisms require food to live. The sun is the main source of energy. Green plants use sun energy to make food through photosynthesis. Animals do not get energy directly from the Sun. Many animals (herbivores) eat plants which use sunlight to make food. Other animals such as tiger, lion eat herbivores to get energy. Therefore, through food chain ecological balance is maintained. Disturbance in any component of ecosystem leads to ecological imbalance.