NCERT Solutions for Class 12 Biology
Chapter 14 Ecosystem

Question 1.
Fill in the blanks
(a) Plants are called as ___ because they fix carbon dioxide.
(b) In an ecosystem dominated by trees, the pyramid (of numbers) is ___ type.
(c) In aquatic ecosystem, the limiting factor for the productivity is ___
(d) Common detritivores in our ecosystem are ____
(e) The major reservoir of carbon on earth is ___
Solution:
(a) producers
(b) inverted or spindle
(c) light
(d) saprotrophs
(e) oceans

Question 2.
Which one of the following has the largest population in a food chain?
(a) Producers
(b) Primary consumers
(c) Secondary consumers
(d) Decomposer's
Solution:
(d) decomposer's

Question 3.
The second trophic level in a lake is
(a) phytoplankton
(b) zooplankton
(c) benthos
(d) fishes.
Solution:
(b) zooplankton

Question 4.
Secondary producers are
(a) herbivores
(b) producers
(c) carnivores
(d) none of these
Solution:
(a) herbivores

Question 5.

What is the percentage of photosynthetically active radiation (PAR), in the incident solar radiation.

(a) 100%

(b) 50%

(c) 1 – 5%

(d) 2 – 10%

Solution:

(b) 50%

Question 6.

Distinguish between

(a) Grazing food chain and detritus food chain

(b) Upright and inverted pyramid

(c) Litter and detritus

(d) Production and decomposition

(e) Food chain and food web

(f) Primary and secondary productivity

Solution:

(a) Differences between grazing food chain and detritus food chain are as follows

	Grazing food chain	Detritus food chain
(i)	The chain begins with producers as the first trophic level.	The chain begins with detritivores and decomposers as the first trophic level.
(ii)	Energy for the food chain comes from sun.	Energy for the food chain comes from organic remains of detritus.
(iii)	Food chain adds energy into the ecosystem.	It retrieves food energy from detritus and prevents its wastage.
(iv)	The food chain binds up inorganic nutrients.	The food chain helps in releasing inorganic nutrients to the cycling pool.

(b) Differences between upright and inverted pyramids are as follows :

	Upright pyramid	Inverted pyramid
(i)	When the number of producers or their biomass is maximum in an ecosystem like grassland ecosystem and decreases progressively at each trophic level in a food chain, the pyramid of number and biomass is upright.	When the number of individuals or their biomass at producer level is minimum and increases progressively at each trophic level in a food chain, an inverted pyramid is formed *e.g.*, pyramid of numbers in tree ecosystem, pyramid of biomass in aquatic/ pond ecosystem.
(ii)	Pyramid of energy is always upright.	Pyramid of numbers and pyramid of biomass may be inverted.
(iii)	The base bar comprising producers is the largest and bar of vertex of the pyramid comprising top consumers is the smallest.	The base bar comprising producers is the smallest and the bar of vertex comprising top consumers is the largest.

(c) Differences between litter and detritus are as follows :

	Litter	Detritus
(i)	It is mostly made up of dried fallen plant matter.	It is remains of plants and animals *i.e.*, it is freshly deposited organic matter.
(ii)	It is above ground.	Detritus can be above ground or below ground.

(d) Differences between production and decomposition are as follows :

	Production	Decomposition
(i)	It is the phenomenon of synthesis of fresh biomass.	It is the phenomenon of degradation of waste biomass (complex or organic matter) by decomposers.
(ii)	It builds up biomass from inorganic nutrients.	It releases inorganic nutrients from the biomass into the environment.
(iii)	It traps energy.	It releases energy.

(e) Differences between food chain and food web are as follows:

	Food chain	Food web
(i)	It is a single straight pathway through which food energy travels in the ecosystem.	It consists of number of interconnected food chains through which food energy passes in the ecosystem.
(ii)	Members of higher trophic level feed upon a single type of organisms of lower trophic level.	Members of higher trophic level can feed upon a number of alternative organisms of the lower trophic level.
(iii)	Presence of separate or isolated food chains adds to the instability of the ecosystem.	Presence of food webs increases the stability of the ecosystem.
(iv)	It does not add to adaptability and competitiveness of the organisms.	Food webs increase adaptability and competitiveness of the organisms.

(f) Differences between primary productivity and secondary productivity are as follows :

	Primary productivity	Secondary productivity
(i)	It is rate of synthesis of organic matter by producers.	It is rate of synthesis of organic matter by consumers.
(ii)	It is comparatively quite high.	It is comparatively small.
(iii)	It is due to synthesis of fresh organic matter from inorganic raw material.	It is due to synthesis of organic matter from organic matter.

Question 7.

Describe the components of an ecosystem.

Solution:

Ecosystem: The system resulting from the interaction between organisms and their environment is called an ecosystem.
(a) Producers: Organisms, which can synthesize their own food are included under producers, e.g., Volvox, Pandorina, Oedogonium, Saggitaria, Utricularia, Azolla, Trapa, Lemna, Typha, Nymphaea etc. form the producer class of the pond ecosystem.

(b) Consumers:

- Primary consumer: Animals, which feed on producers are included in this category e.g., Daphnia, Cyclops, Paramoecium, Amoeba, and small fishes.
- Secondary consumers: Primary consumers also serve as food for water snakes, a few tortoises, few types of fish, etc. hence, these are carnivores.
- Tertiary consumers: Secondary consumers also serve as food for aquatic birds like kingfishers, cranes, big fish and these together form a top-class carnivorous group and called tertiary consumers.

(c) Decomposers: All producers and consumers die and accumulate on the floor of the pond. Even the waste material and feces of these animals get accumulated on the floor of the pond. Similarly, the floor of the pond is also occupied by decomposers, which include bacteria and fungi. These decomposers decompose complex organic compounds of then- bodies into simpler forms which are finally mixed with the soil of the floor of ponds. These are again absorbed by the roots of producer plants and thus matter is recycled.

Question 8.
Define ecological pyramids and describe with examples, pyramids of number and biomass.
Solution:
An ecological pyramid is a graphic representation of an ecological parameter, as a number of individuals present in various trophic levels of a food chain with producers forming the base and top carnivores the tip. Ecological pyramids were developed by Charles Elton (1927) and are, therefore, also called Eltonian pyramids.

There are three types of ecological pyramids, namely,

- Pyramid of numbers
- Pyramid of biomass
- Pyramid of energy

Pyramid of numbers: It is a graphic representation of the number of individuals per unit area of various trophic levels stepwise with producers at the base and top carnivores at the tip. In a grassland, the producers, which are mainly grasses, are always maximum in number. This number then shows a decrease towards the apex, as the primary consumers (herbivores) like rabbits, mice, etc. are lesser in number than the grasses; the secondary consumers, snakes, and lizards are lesser in number than the rabbits and mice. Finally, the top (tertiary) consumers hawks or other birds,

are the least in number. Thus, the pyramid becomes upright.

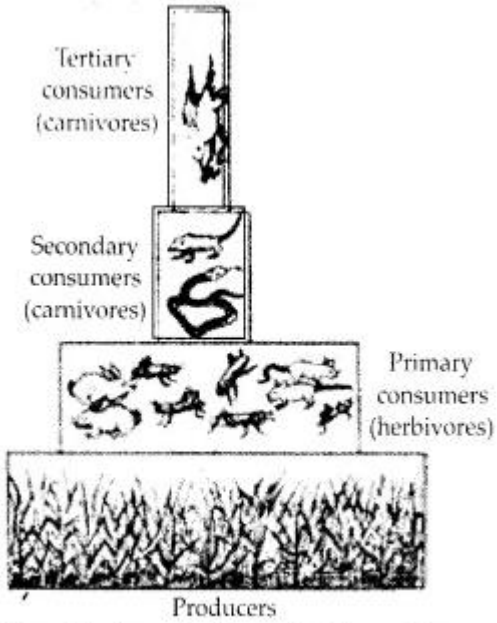

Fig.: Pyramid of number in grassland ecosystem

Pyramid of biomass: The amount of living organic matter (fresh and dry weight) is called biomass. Here, different trophic level of the ecosystem are arranged according to the biomass of the organisms. In grassland and forest, there is generally a gradual decrease in biomass of organisms at successive levels from the producers to the top carnivores. Thus these pyramids are upright. But in pond ecosystem, it is inverted because the biomass gradually increases from the producers to carnivores.

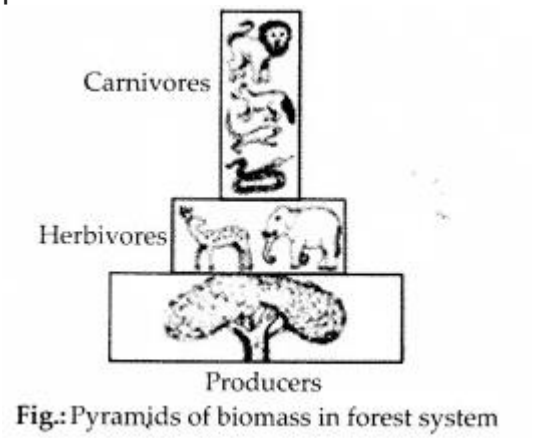

Fig.: Pyramids of biomass in forest system

Question 9.

What is primary productivity? Give a brief description of factors that affect primary productivity.

Solution:

The rate of biomass production is called productivity.

It is expressed in terms of $g^{-2}yr^{-1}$ or$(Kcal\text{-}m^{-2})$ yr^{-1} to compare the productivity of ecosystems.

It can be divided into Gross Primary Productivity (GPP) and Net Primary Productivity (NFP).

Gross Primary Productivity of an ecosystem is the rate of production of organic matter during photosynthesis. A considerable amount of GPP is utilized by plants in respiration.

Gross primary productivity minus respiration losses (R), is the Net Primary Productivity (NPP). GPP – R=NPP.
Primary productivity depends on:

- The plant species inhabiting a particular area.
- The environmental factors.
- Availability of nutrients.
- Photosynthetic capacity of plants.

Question 10.

Define decomposition and describe the processes and products of decomposition.

Solution:

Decomposition is the breakdown of dead or wastes organic matter by micro-organisms. Decomposition is both physical and chemical in nature. Processes involved in decomposition are – fragmentation, catabolism & leaching.

- Fragmentation – The process primarily due to the action of detritus feeding invertebrate (detritivores) causes it to break into smaller particles. The detritus gets pulverized when passing through the digestive tracts of animals. Due to fragmentation, the surface area of detritus particles is greatly increased.
- Catabolism – Enzyme degradation of detritus into simpler organic substances by bacteria and fungi.
- Leaching – The process by which nutrients, chemicals, or contaminants are dissolved & carried away by water, or are moved into a lower layer of soil.

Various inorganic and organic substances are obtained by decomposition. Inorganic substances are obtained in the process of mineralization while organic substances are obtained in humification. A dark coloured amorphous substance called humus is formed by decomposition. Humus is highly resistant to microbial action & undergoes extremely slow decomposition. It serves as a reservoir of nutrients.

Question 11.

Give an account of energy flow in an ecosystem.

Solution:

Ecosystems require a constant input of energy as every component of an ecosystem is regularly dissipating energy.

Two laws of thermodynamics govern this flow of energy. According to the first law of thermodynamics, energy can be transferred as well as transformed but is neither created nor destroyed. According to the second law of thermodynamics, every

activity involving energy transformation is accompanied by the dissipation of energy. Except for deep hydrothermal ecosystems, the source of energy in all ecosystems is solar energy. 50% of the solar energy incident over the earth is present in PAR (photosynthetically active radiation).

Energy flow in an ecosystem is always unidirectional or one way, i.e., solar radiation → producers → herbivores → carnivores. It cannot pass in the reverse direction. There is a decrease in the content and flow of energy with the rise in trophic level. Only 10% of energy is transferred from one trophic level to the next.
Producer biomass (1000 K cal) → Herbivore biomass (100 K cal) → Carnivore I biomass (10 Kcal) Carnivore II biomass (1 Kcal)

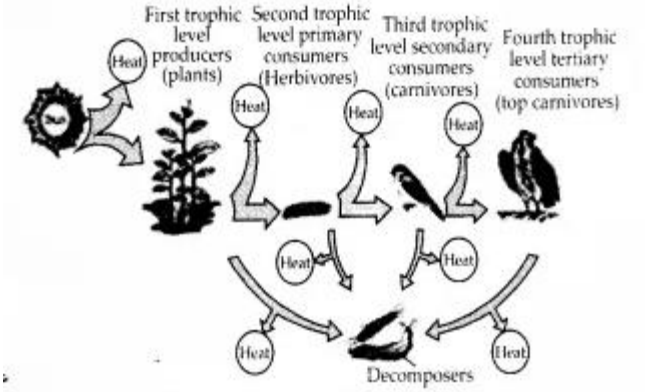

Fig.: Energy flow through different trophic levels

Question 12.
Write important features of a sedimentary cycle in an ecosystem
Solution:
Sedimentary Biogeochemical cycle:- It is the circulation of a biogeochemical between the biotic and abiotic compound of an ecosystem is a nongaseous being lithosphere or sediments of the earth. Sedimentary cycles occur in the case of phosphorus, calcium, magnesium, zinc, copper, etc.

Question 13.
Outline salient features of carbon cycling in an ecosystem.
Solution:
Carbon constitutes 49 percent of the dry weight of organisms and is next only to water. 71 percent of carbon is found dissolved in oceans. This ocean reservoir regulates the amount of carbon dioxide in the atmosphere. Fossil fuels also represent a reservoir of carbon. Carbon cycling occurs through the atmosphere, ocean, and living and dead organisms. 4×10^{13} kg of carbon is fixed in the biosphere through photosynthesis annually.

A considerable amount of carbon returns to the atmosphere as Co_2 through respiratory activities of the producers and consumers. Decomposers also contribute substantially to the CO_2 pool by their processing of waste materials and dead organic matter of land or oceans. Some amount of fixed carbon is lost to sediments and removed from circulation. Burning of wood, forest fire and combustion of

organic matter, fossil fuels, volcanic activity are additional sources for releasing Co_2 into the atmosphere.

Human activities have significantly influenced the carbon cycle. Rapid deforestation and the massive burning of fossil fuels for energy and transport have significantly increased the rate of release of carbon dioxide into the atmosphere.

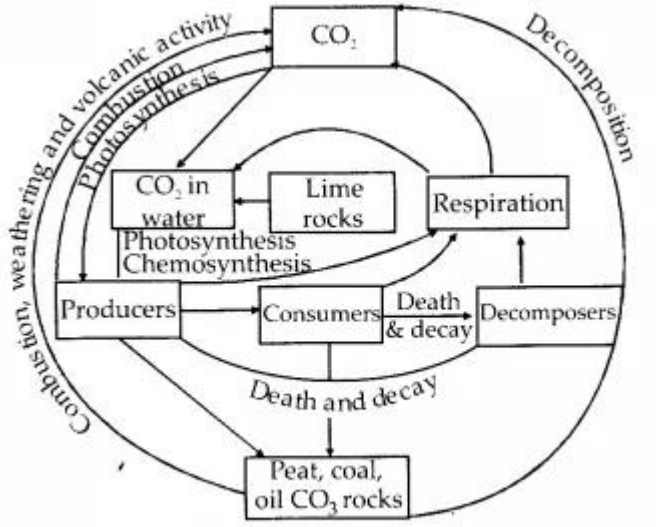

Fig.: Carbon cycle