Ecosystem - Exemplar Solutions

Multiple Choice Questions (MCQs)

1. Decomposers like fungi and bacteria are
(i) autotrophs
(ii) heterotrophs
(iii) saprotrophs
(iv) chemo-autotrophs
Choose the correct answer
(a) (i) and (iii)
(b) (i) and (iv)
(c) (ii) and (iii)
(d) (i) and (ii)
Ans. (c) (ii) and (iii)

2. The process of mineralisation by microorganisms helps in the release of
(a) inorganic nutrients from humus
(b) both organic and inorganic nutrients from detritus
(c) organic nutrients from humus
(d) inorganic nutrients from detritus and formation of humus.
Ans. (a) inorganic nutrients from humus

3. Productivity is the rate of production of biomass expressed in terms of
(i) (kcal m^{-3}) yr^{-1}
(ii) g^{-2} yr^{-1}
(iii) g^{-1} yr^{-1}
(iv) (kcal m^{-2}) yr^{-1}
(a) (ii)
(b) (iii)
(c) (ii) and (iv)
(d) (i) and (iii)
Ans. (c) (ii) and (iv)

4. An inverted pyramid of biomass can be found in which ecosystem?
(a) Forest
(b) Marine
(c) Grassland
(d) Tundra
Ans. (b) Marine.

5. Which of the following is not a producer?
(a) *Spirogyra*

(b) *Agaricus*
(c) *Volvox*
(d) *Nostoc*
Ans. (b) *Agaricus*

6. Which of the following ecosystems is most productive in terms of net primary production?
(a) Deserts
(b) Tropical rainforests
(c) Oceans
(d) Estuaries
Ans. (b) Tropical rain forests

7. Pyramid of numbers is
(a) Always upright
(b) Always inverted
(c) Either upright or inverted
(d) Neither upright nor inverted
Ans. (c) Either upright or inverted

8. Approximately how much of the solar energy that falls on the leaves of a plant is converted to chemical energy by photosynthesis?
(a) Less than 1%
(b) 2-10%
(c) 30%
(d) 50%
Ans. (b) 2-10%

9. Among the following, where do you think the process of decomposition would be the fastest?
(a) Tropical rain forest
(b) Antarctic
(c) Dry arid region
(d) Alpine region
Ans. (a) Tropical rain forest

10. How much of the net primary productivity of a terrestrial ecosystem is eaten and digested by herbivores?
(a) 1%
(b) 10%
(c) 40%
(d) 90%
Ans. (d) 90%

11. During the process of ecological succession, the changes that take place in communities are
(a) orderly and sequential

(b) random
(b) very quick
(d) not influenced by the physical environment
Ans. (a) orderly and sequential

12. Climax community is in a state of
(a) non-equilibrium
(b) equilibrium
(c) disorder
(d) constant change
Ans. (b) equilibrium

13. Among the following bio-geo-chemical cycles, which one does not have losses due to respiration?
(a) Phosphorus
(b) Nitrogen
(c) Sulphur
(d) All of these
Ans. (d) All of these

14. The sequence of communities of primary succession in water is
(a) Phytoplankton, sedges, free-floating hydrophytes, rooted hydrophytes, grasses, and trees.
(b) Phytoplankton, free-floating hydrophytes, rooted hydrophytes, sedges, grasses, and trees.
(c) Free-floating hydrophytes, sedges, phytoplankton, rooted hydrophytes, grasses, and trees.
(d) Phytoplankton, rooted submerged hydrophytes, floating hydrophytes, reed swamp, sedges, meadow, and trees.
Ans. (d) Phytoplankton, rooted submerged hydrophytes, floating hydrophytes, reed swamp, sedges, meadow, and trees.

15. The reservoir for the gaseous type of bio-geochemical cycle exists in
(a) stratosphere
(b) atmosphere
(c) ionosphere
(d) lithosphere
Ans. (b) atmosphere

16. If the carbon atoms fixed by producers have already passed through three species, the trophic level of the last species would be
(a) scavenger
(b) tertiary producer
(c) tertiary consumer
(d) secondary consumer
Ans. (c) tertiary consumer

17. Which of the following types of ecosystem is expected in an area where evaporation exceeds precipitation, and mean annual rainfall is below 100mm
(a) Grassland
(b) Shrubby forest
(c) Desert
(d) Mangrove
Ans. (c) Desert

18. The zone at the edge of a lake or ocean, which is alternatively exposed to air and immersed in water, is called
(a) pelagic zone
(b) benthic zone
(c) lentic zone
(d) littoral zone
Ans. (d) littoral zone

19. Edaphic factor refers to
(a) water
(b) soil
(c) relative humidity
(d) altitude
Ans. (b) Soil

20. Which of the following is an ecosystem service provided by a natural ecosystem?
(a) Cycling of nutrients
(b) Prevention of soil erosion
(c) Pollutant absorption and reduction of the threat of global warming
(d) All of the above
Ans. (d) All of the above

Very Short Answer Type Questions

1. Name an organism found as secondary carnivore in an aquatic ecosystem.
Ans. In an aquatic ecosystem, the food chain can be drawn as follows
Producer (Phytoplankton) → Primary consumer (Zooplankton) → Secondary consumer (small fish and water beetle) (Ist to carnivore) → Tertiary consumer (IInd carnivore like large fish, water birds like fowl and duck).
So, the large fish and water birds like ducks and waterfowl, which are the tertiary consumers in an aquatic ecosystem, occupy a position of secondary carnivore.

2. What does the base tier of the ecological pyramid represent?
Ans. The base tier of the ecological pyramids represents the producers or the first trophic level in the case of the three ecological pyramids.

- (i) Pyramid of numbers
- (ii) Pyramid of biomass

- (iii) Pyramid of energy

3. Under what conditions would a particular stage in the process of succession revert back to an earlier stage?
Ans. Natural disturbances like fire, flood, or any other natural disaste,r and anthropogenic activities can revert back to an earlier stage of succession.

4. Arrange the following as observed in vertical stratification of a forest;
Grass, Shrubby plants, Teak, Amaranths.
Ans. Vertical stratification (dispersion) of species in a forest ecosystem is arranged as grass (floor of forest) → Amaranthus → Shrubby plants → Teak (tree).

5. Name an omnivore which occurs in both grazing food chain and the decomposer food chain.
Ans. Cockroaches and crows are two omnivores that are present in both grazing and predator and detritus food chains.

6. Justify the pitcher plant as a producer.
Ans. Pitcher plant (Nepenthes) is an insectivores plant, which is chlorophyllous and capable of trapping solar radiation for chemical energy for photosynthesis. It is insectivorous plant which are produced in soil lacking nitrogen thus to make up for their nitrogen deficiency, they trap insects.

7. Name any two organisms which can occupy more than one trophic level in an ecosystem.
Ans. Human beings and birds (sparrows) can be frequently seen in more than one trophic level, in an ecosystem.

8. In the North East region of India, during the process of jhum cultivation, forests are cleared by burning and left for regrowth after a year of cultivation. How would you explain the regrowth of forest in ecological terms?
Ans. Forests that are cleared by burning and left for regrowth will show secondary succession. Since soil is already present, the buried seeds are likely to germinate. Due to wind dispersal and some other natural forces, new seeds will be brought into the area, and new species will colonise the forest again.

9. Climax stage is achieved quickly in secondary succession as compared to primary succession. Why?
Ans. The rate of ecological succession is quicker in secondary succession as compared to primary successio,n as the soil (substratum) is already available for further succession. While in primary succession, the succession starts from bare rocks. This takes time for the first colonisation by plant,s as there are no nutrient-holding mechanisms.

10. Among bryophytes, lichens, and ferns, which one is a pioneer species in a xeric succession?
Ans. The species that invade a bare area are called pioneer species. In a xeric succession, the pioneer species are usually lichens, then bryophyte,s which are succeeded by ferns and some other bigger plants.

Lichen produces lichen acid and carbonic acid, which corrodes the rock surface and releases minerals required for growth. The corroded rock accumulates soil particles by wind and provides substrate for Bryophytes and ferns.

11. What is the ultimate source of energy for the ecosystems?
Ans. Solar radiation is the ultimate source of energy for the ecosystem, except for deep hydrothermal ecosystems.

12. Is the common edible mushroom an autotroph or a heterotroph?
Ans. The common edible mushroom (Agaricus) is achlorophyllous (does not possess chlorophyll) and is a heterotroph.

13. Why are oceans least productive?
Ans. Oceans are the least productive because

- (i) There is insufficient radiation as sunlight decreases with the increasing depth of the ocean.
- (ii) Oceans are nitrogen-deficient, which is an important nutrient for plants.
- (iii) Conditions of high salinity, which are not favourable for all plants.
- (iv) There is no substratum to support plants.

14. Why is the rate of assimilation of energy at the herbivore level called secondary productivity?
Ans. The rate of assimilation of energy at the herbivore level is called secondary productivity because the biomass available to the organisms of the next trophic level (consumer) for further consumption is a result of the primary productivity, which is formed by autotrophs (plants).

15. Why are nutrient cycles in nature called biogeochemical cycles?
Ans. Nutrient cycles are called biogeochemical cycles because ions/molecules of a nutrient are transferred from the environment (rocks, air, and water) to organisms (life) and then brought back to the environment in a cyclic pathway. The literal meaning of biogeochemical is bioliving organisms and georocks, air, and water.

16. Give any two examples of xerarch succession.
Ans. Xerarch succession of ecological communities originates in extremely dry conditions, such as sand deserts and rock deserts (as there is no water and the substratum does not absorb rainwater).

17. Define self-sustainability.
Ans. Self-sustainability is the maintenance of an ecosystem itself or naturally. i.e., A system that maintains itself by its own independent efforts is a self-sustainable ecosystem.

18. Given below is a figure of an ecosystem. Answer the following questions.

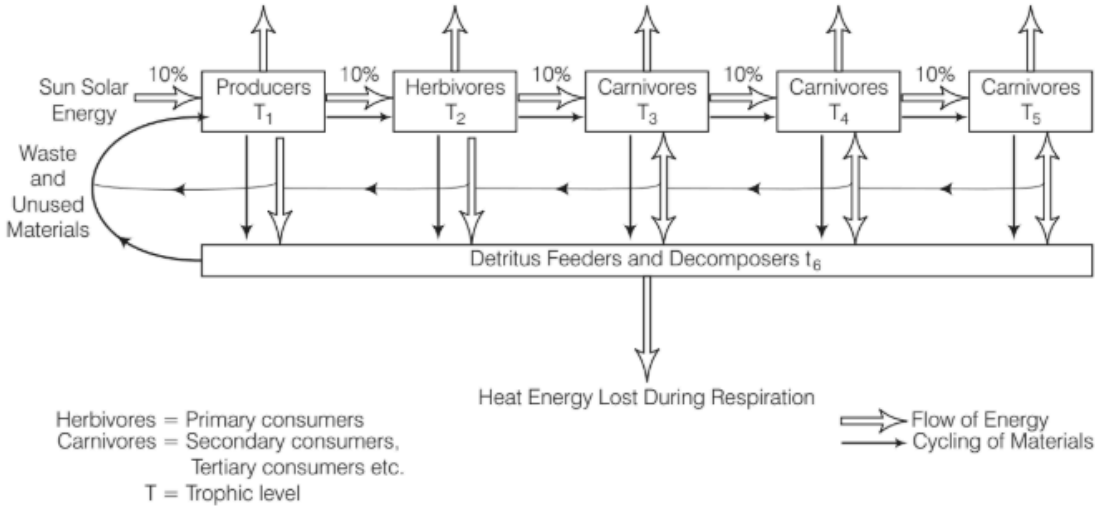
(i) What type of ecosystem is shown in the figure?
(ii) Name any plant that is characteristic of such ecosystem.
Ans.

- (i) It is a tropical deciduous forest ecosystem.
- (ii) In India, this type of forest ecosystem is characterised by Tectona, Dipterocarpus, Jamun, Amla, Palas, mahua, and Semul plants.

19. What is common to earthworms, mushrooms, soil mites, and dung beetles in an ecosystem?
Ans. They are all designated as primary consumers in a detritus food chain and are termed detritivores.

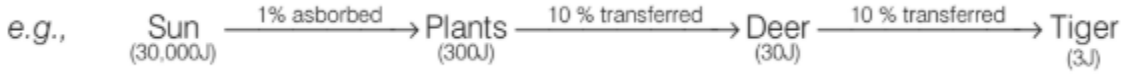
Short Answer Type Questions

1. Organisms at a higher trophic level have less energy available. Comment.
Ans. Energy flow in the ecosystem follows the 10% energy flow law, proposed by Lindeman. According to this law, only 10% of the energy available at each trophic level gets transferred to the next trophic level; the rest is lost in the environment as heat. As we move to higher trophic levels, the energy available to organisms keeps decreasing. Thus, the top carnivore gains the least energy in a food chain. Heat energy is last during Respiration.



10% energy flow low showing transfer of energy from one trophic level to others

2. The number of trophic levels in an ecosystem are limited. Comment.
Ans. The number of trophic levels in an ecosystem is limited to 4-5, because the amount of energy flow decreases with successive trophic levels as only 10% of energy is transferred from one trophic level to the next successive level. So the rest of the energy is lost in the form of respiration and other vital activities to maintain life. If more trophic levels are present, the residual energy will be limited and decrease to such an extent that it cannot further support any trophic level by the flow of energy.
So, the food chain is generally limited to 3-4 trophic levels only.



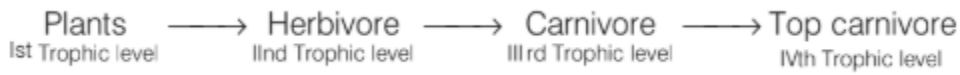
3. Is an aquarium a complete ecosystem?
Ans. An aquarium is a man-made ecosystem (artificial). If an ecosystem possesses all physical and biological components, then it is said to be complete. Since an aquarium has biotic (plants and fish) and abiotic components (air, water) required for the survival of fish, it is a complete ecosystem.

4. What could be the reason for the faster rate of decomposition in the tropics?
Ans. Tropics are characterised by high temperature and moisture, and the soil is rich in humus and minerals. As the decomposition rate is regulated by climatic factors, optimum temperature and humidity enhance the activity of decomposers while the dead remains are also available in large amounts, which supports the faster rate of decomposition in the tropics.

5. Human activities interfere with carbon cycle. List any two such activities.
Ans. Two human activities that interfere with carbon cycles are

- (i) Rapid deforestation and
- (ii) Massive burning of fossil fuels for energy and transport.

6. Flow of energy through various trophic levels in an ecosystem is unidirectional and non-cyclic. Explain.
Ans. Flow of energy in an ecosystem is always unidirectional, i.e., energy flows in one direction and is noncyclic, like



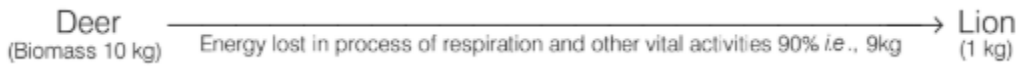
As the energy content is decreasing from Ist trophic level to the next trophic level and so on, the energy cannot pass in the reverse direction.

7. Apart from plants and animals, microbes form a permanent biotic component in an ecosystem. While plants have been referred to as autotrophs and animals as heterotrophs. What are microbes referred to as? How do the microbes fulfill their energy requirements?
Ans. Based on nutrition, organisms are classified as autotrophs and heterotrophs. Autotrophs are further categorised into photoautotrophs and chemoautotrophs, while heterotrophs may be parasite, predator, or a

saprophyte, etc. Microbes are saprotrophs and derive nourishment or energy from dead organic matter or remains of plants and animals, and this digestion is extracellular.

8. Poaching of tigers is a burning issue in today's world. What implications would this activity have on the functioning of the ecosystem of which the tigers are an integral part?
Ans. Tiger represents an important part of the food web and help maintain ecological stability. As a carnivore, it keeps a check on the unlimited growth of herbivores the and also removes sick or old animals from the population. It also acts as an indicator of the forest's health.
Saving the tiger means we save the forest. Since tigers (top carnivores of the food chain) cannot live in places where trees or herbivores, that they hunt, have vanished, and in turn secure food and water for all.

9. In relation to energy transfer in ecosystem, explain the statement "10kg of deer's meat is equivalent to 1 kg of lion's flesh".
Ans. In an ecosystem, the flow (transfer) of energy is unidirectional. As energy is trapped in Ist trophic level, only 10% of energy is transferred to the next trophic level.



10. Primary productivity varies from ecosystem to ecosystem. Explain?
Ans. Primary productivity is the rate at which primary producers (plants) capture and store solar radiation to form chemical energy. Primary production depends upon producers (green plants) which are variable in different ecosystems. So, primary productivity varies from ecosystem to ecosystem.

11. Sometimes, due to biotic/abiotic factors the climax remains in a particular seral stage (pre-climax) without reaching climax. Do you agree with this statement? If yes, give a suitable example.
Ans. Sometimes climax remains in a particular seral stage without reaching the climax because during ecological succession, any change in abiotic and biotic components may affect the particular seral stage, leading to a preclimax stage before the climax is achieved. This type of condition occurs presence of seeds and other propagules. This secondarily based area may be invaded by moss or exotic weeds, thus exhibiting succession seriously, and the climax community is never regenerated. In the case of natural calamities like fire, landslide, floods, and change in soil texture.

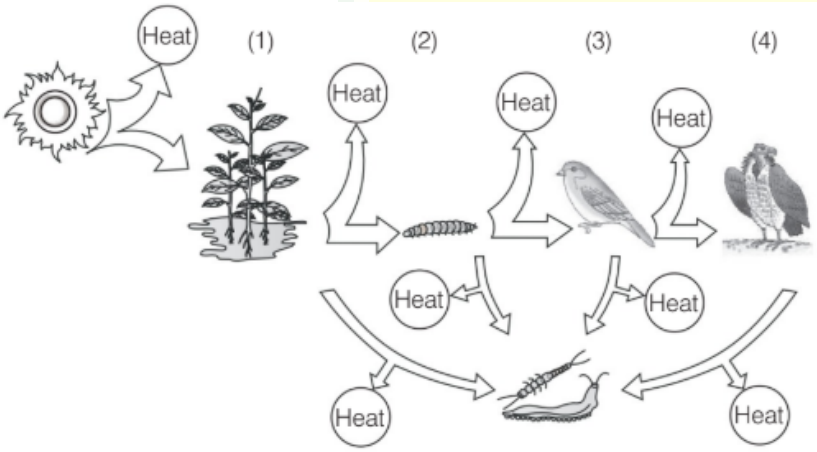
12. What is an incomplete ecosystem? Explain with the help of suitable example.
Ans. An ecosystem comprises biotic and abiotic components. A biotic component includes light, air, water, temperature, humidity, etc, while a biotic factor comprises all living organisms. Absence or limited availability of any component (either abiotic or biotic) makes an ecosystem incomplete, like the profundal and benthic zone in an aquatic ecosystem.

13. What are the shortcomings of ecological pyramids in the study of ecosystems?
Ans. Ecological pyramids are the graphical representation of ecological parameters. These are characterised by the pyramid of numbers, the pyramid of mass, and the pyramid of energy in an ecosystem. Assumption of a simple food chain is the major shortcoming of ecological pyramids. If we do not accommodate the food web, a clear position of or trophic levels of an organism cannot be given.

Saprophytic organisms are not given any place in the ecological pyramid, though they are an important component in an ecosystem.

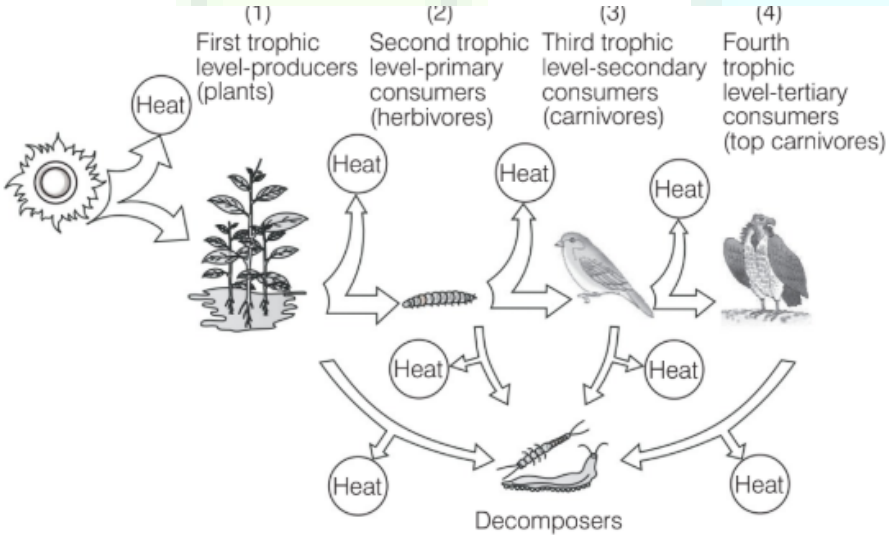
14. How do you distinguish between humification and mineralisation?
Ans. Humification is the process of decomposition of soil that leads to the accumulation of a dark-coloured amorphous substance called humus. Humus is highly resistant to microbial action and undergoes decomposition at a very slow rate.
Mineralisation is the process by which the humus is further degraded by microbes and inorganic nutrients or minerals are released back into the substratum.

15. Fill in the trophic levels (1, 2, 3, and 4) in the boxes provided in the figure.



Ans.

- (i) First trophic level (producers) - Plants
- (ii) Second trophic level (primary consumers) - Herbivores
- (iii) Third trophic level (secondary consumers) - Carnivores
- (iv) Fourth trophic level (tertiary consumers) - Top carnivores



Energy flow through different trophic levels

16. The rate of decomposition of detritus is affected by the abiotic factors like availability of oxygen, pH of the soil substratum, temperature, etc. Discuss.

Ans. Decomposition of dead remains or matter of animals and plants is carried out by microorganisms like bacteria, fungi, etc. The growth rate of these decomposers is affected by abiotic factors like temperature, humidity, pH of soil, and light, etc.

The soil pHaffectst the composition of acidophilic and basophilic microorganisms. In the absence or presence of oxygen, aerobic and anaerobic processes occur.

In the presence of oxygen, complete degradation of the substance occurs, while in the absence of oxygen, there will be an incomplete degradation. Similarly, at high temperatures, microbes can not grow optimally, but high or low temperature favours the growth of stress-tolerant microorganisms.

Long Answer Type Questions

1. A farmer harvests his crop and expresses his harvest in three different ways.

(a) I have harvested 10 quintals of wheat.

(b) I have harvested 10 quintals of wheat today in one acre of land.

(c) I have harvested 10 quintals of wheat in one acre of land, 6 months after sowing.

Do the above statements mean one and the same thing? If your answer is 'yes', give reasons. And if your answer is 'no', explain the meaning of each expression.

Ans.

- (a) Farmer's expression for his crop harvestation (a) he has harvested 10 quintals of wheat,
- (b) He has harvested 10 quintals of wheat in one acre of land
- (c), six months after sowing mean the same thing. Because a crop an artificial ecosystem can be prepared with the inclusion of biotic and abiotic components in a given area.
- Here, abiotic components like water are given by the farmer, while climatic factor like light, humidity, and air is supplied naturally. The living component is the wheat plant, which is obtained on harvesting by the farmer.

2. Justify the following statement in terms of ecosystem dynamics. "Nature tends to increase the gross primary productivity, while man tends to increase the net primary productivity".

Ans. In terms of ecosystem dynamics, flow of energy takes place from one trophic level to the next trophic level and occurs in a unidirectional way.

- About 50% of solar energy incident over the earth is present in Photosynthetic Active Radiation (PAR), and only 2-10% of this PAR is utilised by green plants to form chemical energy (Gross Primary Productivity) (GPP).
- Out of 90% of gross primary productivity is lost during respiration and other vital activities.
- GPP utilised by plants in respiration minus respiration losses is the net primary productivity and is available to the organisms of the next trophic level (herbivores and decomposers) for consumption.
- Gross primary productivity of an ecosystem is the rate of production of organic matter during photosynthesis.
- So nature tends to increase gross primary productivity through supporting a large number of plants (producers) in an ecosystem.

- Net primary productivity is the available biomass for the consumption of heterotrophs (humans and animals). Man tries to increase net primary productivity by cultivating food and other crops that they depend on to fulfill their needs.

The formula to generate NPP is NPP⇋ GPP - R

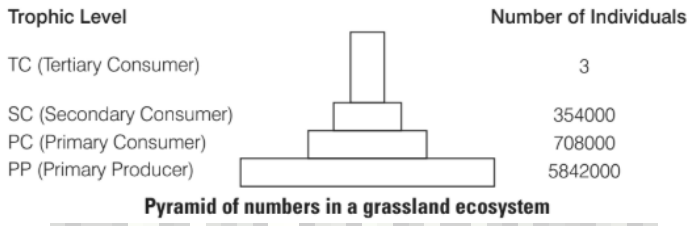
3. Which of the following ecosystems will be more productive in terms of primary productivity? Justify your answer. A young forest, a natural old forest, a shallow polluted lake, alpine meadow.
Ans. Primary Productivity can be defined as the rate at which primary producers (Green plants) trap and store solar radiation in the form of biomass. This is measured in terms of weight (g^{-2}) and in terms of energy (Kcal m^{-2}) per year over a given time.

So, primary productivity varies from ecosystem to ecosystem, and the ecosystem that possesses more producers will be more productive in terms of primary productivity. So young forests grow quicker than older, mature forests and are more productive in terms of productivity. The shallow polluted lake and alpine meadow will be less productive because of a smaller number of producers and a high amount of dead matter.

4. What are the three types of ecological pyramids? What information is conveyed by each pyramid with regard to structure, function, and energy in the ecosystem?
Ans. Ecological Pyramids An ecological pyramid is a graphical representation of an ecological parameter as the number of individuals present in various trophic levels of the food chain.
Properties of the ecological pyramid

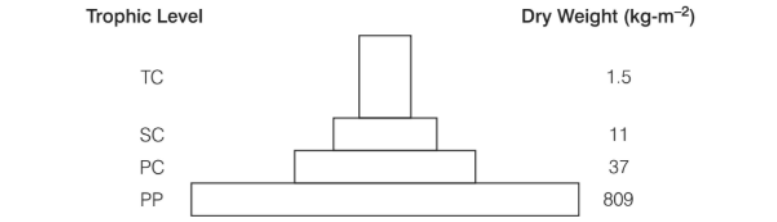
- (i) The trophic structure of an ecosystem is represented in the form of ecological pyramids.
- (ii) The base of each pyramid represents the producers or the first trophic level, while the apex represents the tertiary or top-level consumer.

The three types of ecological pyramids are
(a) The pyramid of numbers shows the relationship between producers and consumers in an ecosystem in terms of numbers. It may be an inverted or an upright pyramid.

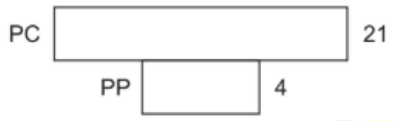


Pyramid of numbers in a grassland ecosystem

(b) Pyramid of biomass shows the relationship between producers and consumers in an ecosystem in terms of biomass. It can be
(a) Upright, e.g., in the case of grassland ecosystem.
(b) Inverted, e.g., in the case of a pond ecosystem.



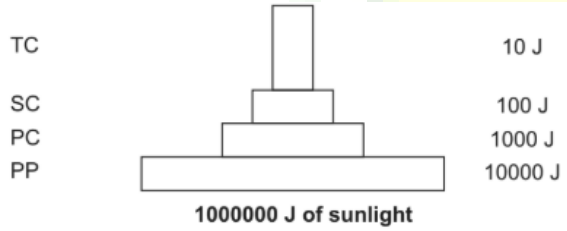
Upright pyramid of biomass shows a sharp decrease in biomass at higher trophic levels



Inverted pyramid of biomass.

A small standing crop of phytoplankton supports a large standing crop of zooplankton

(c) Pyramid of energy is the relationship between producers and consumers in an ecosystem in terms of the flow of energy. It is always upright because energy is always lost as heat at each step.



An ideal pyramid of energy. Observe that primary producers convert only 1% of the energy of the sunlight available to them into Net Primary Productivity.

5. Write a short note on pyramid of numbers and pyramid of biomass.

Ans. Ecological pyramids are graphical representations of the relationship between organisms of different trophic levels that can be expressed in terms of number, biomass, or energy. In most ecosystems, the pyramid of numbers is upright, i.e., producers are more in number than the herbivores and herbivores are more in number than the carnivores. But, the pyramid of numbers may be inverted as in a forest ecosystem, where the number of insects (primary consumers) is greater than the number of trees (producers).

The pyramid of biomass is upright, generally, as the biomass of producers is more than the biomass of herbivores, and that of herbivores is more than the biomass of carnivores. But, it is inverted in ecosystems like the sea ecosystem, where the biomass of fish (primary consumers) exceeds that of phytoplankton (producers).

6. Given below is a list of autotrophs and heterotrophs. With your knowledge about food chain, establish various linkages between the organisms on the principle of 'eating and being eaten'. What is this inter-linkage established known as?

Algae, hydrilla, grasshopper, rat, squirrel, crow, maize plant, deer, rabbit, lizard, wolf, snake, peacock, phytoplankton, crustaceans, whale, tiger, lion, sparrow, duck, crane, cockroach, spider, toad, fish, leopard, elephant, goat, Nymphaea, Spirogyra.

Ans. Food Chain and Food Web A straight line sequence of 'who eats whom' or eating and being eaten in an ecosystem is called a food chain. A network of cross-connecting food chains involving producers, consumers, and decomposers is termed a food web.
Lion, Tiger — Top carnivore (Top trophic level)
Spider, cockroach, lizard, wolf, snake, toad, fish, crane — Secondary Consumer (Third trophic level).
Crustaceans, grasshopper, deer, mouse, squirrel, rabbit, elephant, goat — Primary Consumer (IInd trophic level).
Phytoplankton, algae, Hydrilla, maize plant, Nymphaea, Spirogyra — Producers (Ist trophic level).

7. "The energy flow in the ecosystem follows the second law of thermodynamics." Explain.

Ans. According to the second law of thermodynamics, every activity involving energy transformation (According to the first law, energy can be transferred and transformed) is accompanied by dissipation of energy as heat, and only a part of it is used in building up tissues in an organism.
This trapped energy as biomass is transferred to the next trophic level. According to Lindman's law, only 10% of the stored energy is passed from one trophic level to the successive trophic level.

8. What will happen to an ecosystem if
(a) All producers are removed
(b) All organisms of herbivore level are eliminated and
(c) All top carnivore population is removed
Ans.

- (a) Removal of all producers reduces primary production in the ecosystem. Hence, no biomass will be available to the successive/higher trophic level or heterotrophic organisms.
- (b) Elimination of all organisms at the herbivore level results in an increase in primary productivity, and biomass of producer and carnivorous animals will not survive due to the inavailability of food for herbivores.
- (c) Removal of top carnivores also disturbs the ecosystem as it will result in a huge increase in the number of herbivores, which will finish plants (producers), creating desertification.

9. Give two examples of artificial or man-made ecosystems. List the salient features by which they differ from natural ecosystems.

Ans. Aquarium and farmhouse, are artificial or man-made ecosystems. In an artificial ecosystem, biotic and abiotic components are maintained artificially, like cleaning, feeding, and the supply of oxygen to fish in an aquarium and irrigation in a crop or farm house.
While abiotic and biotic components of natural ecosystems are maintained naturally, like nutrient cycle, self-sustainability, prevention of soil erosion, pollutant absorption, and reduction of threat to global warming (ecological services), etc.

10. The biodiversity increases when one moves from the pioneer to the climax stage. What could be the explanation?

Ans. During ecological succession, biodiversity increases or changes from pioneer to climax stages.
The following are the effects of ecological succession

- (a) It leads to changes in vegetation that affect food and shelter for various types of animals.
- (b) As succession proceeds, the numbers and types of plants, animals, and decomposers also change.

- (c) At any time during primary or secondary succession, natural or human-induced disturbances (fire, deforestation, etc.) can convert a particular seral stage of succession to an earlier stage.
- Also, such disturbances can create new conditions that encourage some species and discourage or eliminate other species of producersr, consumers, and decomposers.
- (d) Over time, they are succeeded by bigger plants and, ultimately, a stable climax forest community is attained.
- (e) The climax community remains stable if the environment remains unchanged.
- (f) With time, the xerophytic habitat may get converted into a mesophytic one.

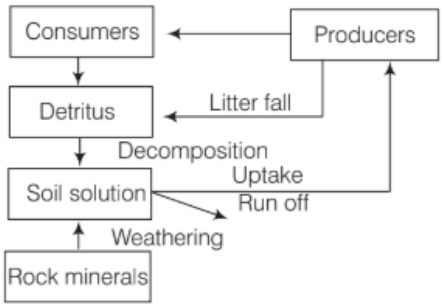
11. What is a biogeochemical cycle? What is the role of the reservoir in a biogeochemical cycle? Give an example of a sedimentary cycle with reservoir located in Earth's crust.

Ans. Biogeochemical Cycle

- (i) The movement of nutrient elements through the various components of an ecosystem is called nutrient cycling or biogeochemical cycles (Bio–living; geo–including air, water, and rocks).
- (ii) Nutrient cycles are of two types
    - (a) Gaseous
    - (b) Sedimentary
- (iii) Atmosphere is the reservoir for the gaseous type of nutrient cycle (e.g., nitrogen and carbon cycle).
- (iv) Earth's crust is the reservoir of the sedimentary cycle (e.g., the sulphur and phosphorus cycles).
- (v) The function of the reservoir is to meet the deficit, which occurs due to an imbalance in the rate of influx and efflux.
- (vi) Environmental factors, e.g., soil, moisture, pH, temperature, etc., regulate the rate of release of nutrients into the atmosphere.

Phosphorus Cycle

- The phosphorus cycle is an example of a sedimentary nutrient cycle since it moves from land and sis edimented at the bottom of the seas, then back to land again.
- The natural reservoir of phosphorus is the earth's crust. Rock contains phosphorus in the form of phosphates. By weathering and soil erosion, phosphates enter streams, rivers, and then into the oceans.
- With great movements of the crustal plates, the sea floor is uplifted and phosphates become exposed on the drained land surfaces. From here, weathering over long periods of time releases phosphates.
- From rocks, a minute amount of these phosphates dissolves in the soil and is absorbed by the roots of the plants.
- Herbivores and other animals obtain this element from plants when they consume plants as their food.
- The waste products and the dead organisms are decomposed by phosphate-solubilising bacteria ,thus releasing phosphorus.



A simplified model of phosiphorus cycling in a terrestrial ecosystem

12. What will be the P/R ratio of a climax community and a pioneer community? What explanation could you offer for the changes seen in P/R ratio of a pioneer community and the climax community?

Ans. Production/Respiration ratio (P/R) ratio. It shows the relationship between gross production and total community respiration, where P/R=1 is a steady state community result. This result may be instantaneously daily or over a longer period. If P/R is persistently greater or less than/then organic matter either accumulates or is depleted, respectively.

Pioneer Community	**Climax Community**
The species that invade a base area are called pioneer species on base rocks, these are generally lichens.	It is a final biotic community that develops in an area.
In an aquatic ecosystem, there are phytoplanktons.	It occurs over an area previously occupied by several communities.
In a pioneer community, the P/R ratio will be more than one.	Inthe climax community, the P/R ratio will be 1.