**MULTIPLE-CHOICE QUESTIONS**

**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**
**Solution:**
Option (c) is the answer.

**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.**
**Solution:**
Option (a) is the answer.

**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 andiii**
**Solution:**
Option (c) is the answer.

**4. An inverted pyramid of biomass can be found in which the ecosystem?**
**a. Forest**
**b. Marine**
**c. Grassland**
**d. Tundra**
**Solution:**
Option (b) is the answer.

**5. Which of the following is not a producer?**
**a. Spirogyra**
**b. Agaricus**
**c. Volvox**
**d. Nostoc**
**Solution:**
Option (b) is the answer.

**6. Which of the following ecosystems is most productive in terms of net**

**primary production?**
**a. Deserts**
**b. Tropical rain forests**
**c. Oceans**
**d. Estuaries**
**Solution:**
Option (b) is the answer.

**7. Pyramid of numbers is:**
**a. Always upright**
**b. Always inverted**
**c. Ether upright or inverted**
**d. Neither upright nor inverted.**
**Solution:**
Option (c) is the answer.

**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%**
**Solution:**
Option (b) is the answer.

**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**
**Solution:**
Option (a) is the answer.

**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%**
**Solution:**
Option (b) is the answer.

**11. During the process of ecological succession the changes that take place in communities are:**
**a. Orderly and sequential**

**b. Random**
**c. Very quick**
**d. Not influenced by the physical environment.**
**Solution:**
Option (a) is the answer.

**12. A climax community is in a state of:**
**a. non-equilibrium**
**b. equilibrium**
**c. disorder**
**d. constant change.**
**Solution:**
Option (b) is the answer.

**13. Among the following biogeochemical cycles which one does not have losses due to respiration?**
**a. Phosphorus**
**b. Nitrogen**
**c. Sulphur**
**d. All of the above**
**Solution:**
Option (d) is the answer.

**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.**
**Solution:**
Option (b) is the answer.

**15. The reservoir for the gaseous type of bio-geochemical cycle exists in**
**a. stratosphere**
**b. atmosphere**
**c. ionosphere**
**d. lithosphere**
**Solution:**
Option (b) is the answer.

**16. If the carbon atoms fixed by producers already have passed through three species, the trophic level of the last species would be.**
**a. scavenger**

**b. tertiary producer**
**c. tertiary consumer**
**d. secondary consumer**
**Solution:**
Option (c) is the answer.

**17. Which of the following type 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**
**Solution:**
Option (d) is the answer.

**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 one**
**d. Littoral zone**
**Solution:**
Option (c) is the answer.

**19. Edaphic factor refers to:**
**a. Water**
**b. Soil**
**c. Relative humidity**
**d. Altitude**
**Solution:**
Option (b) is the answer.

**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**
**Solution:**
Option (d) is the answer.

**VERY SHORT ANSWER TYPE QUESTIONS**

**1. Name an organism found as a secondary carnivore in an aquatic ecosystem.**

**Solution:**
Siluriformes or Catfish are a secondary carnivorous organism in an aquatic ecosystem.

**2. What does the base tier of the ecological pyramid represent?**
**Solution:**
The base tier of the ecological pyramid represents the producers in an ecosystem.

**3. Under what conditions would a particular stage in the process of succession revert to an earlier stage?**
**Solution:**
When there occurs a natural calamity like earthquakes, landslides, volcanic eruptions or human-induced activities like fire, deforestation etc a particular stage in the process of succession revert back to an earlier stage.

**4. Arrange the following as observed in vertical stratification of a forest: Grass, Shrubby plants, Teak, Amaranths.**
**Solution:**
Here the forest vertical stratification order is Grass, Amaranths, Shrubby plants, Teak. The grass is the smallest in height whereas the teak trees are the highest in height.

**5. Name an omnivore which occurs in both grazing food chain and the decomposer food chain.**
**Solution:**
Crow is a very common example of an omnivore which is present in the grazing food chain.

**6. Justify the pitcher plant as a producer.**
**Solution:**
Pitchers plants have the green pigments known as chlorophyll and therefore, they are photosynthetic and can prepare food on their own. This makes them producers.

**7. Name any two organisms which can occupy more than one trophic level in an ecosystem.**
**Solution:**
Human and sparrow are those which can occupy more than one tropic level in the 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 the ecological term?**
**Solution:**
The regrowth of the forest is called secondary succession.

**9. Climax stage is achieved quickly in secondary succession as compared to primary succession. Why?**
**Solution:**
In primary succession, the process begins from a bare rock whereas during the secondary succession the soil is already left behind containing nutrients and minerals.

**10. Among bryophytes, lichens and fern which one is a pioneer species in a xeric succession?**

**Solution:**
Lichens are the pioneer species, which are the first to invade the bare land.

**11. What is the ultimate source of energy for the ecosystems?**
**Solution:**
Solar energy is considered to be the primary source of energy.

**12. Is the common edible mushroom an autotroph or a heterotroph?**
**Solution:**
Common edible mushroom is heterotroph. The edible mushroom belongs to the kingdom fungi which does not synthesize their food.

**13. Why are oceans least productive?**
**Solution:**
Oceans are least productive because of the limited solar light and nutrients and have high saline water.

**14. Why is the rate of assimilation of energy at the herbivore level called secondary productivity?**
**Solution:**
As the consumers assimilate primary products synthesised by producers, it results in the formation of new organic mass. Therefore, the rate of production of organic matter by heterotrophs is called secondary productivity.

**15. Why are nutrient cycles in nature called biogeochemical cycles?**
**Solution:**
A biogeochemical cycle refers to the biological cycle in the geo i.e. rocks, air etc. It involves the cycling of nutrients.

**16. Give any two examples of xerarch succession**
**Solution:**
Lithosere- takes place on rocks
Psammosere- takes place on the sandy habitat

**17. Define self-sustainability.**
**Solution:**
Self-sustainability is the ability of an ecosystem to maintain itself.

**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 an ecosystem.**
**Solution:**
i) It is showing Tropical deciduous ecosystem
ii) E.g. Amla, Palas tree etc.

**19. What is common to the earthworm, mushroom, soil mites and dung beetle in an ecosystem?**
**Solution:**
All these organisms are detrivore, decomposing organisms which feed on dead remains of plants and animals.

**SHORT ANSWER TYPE QUESTIONS**

**1. Organisms at a higher trophic level have less energy available. Comment.**
**Solution:**
This can be explained by the 10 per cent law which states that each successive higher trophic level organism transfers 10% of its energy and the rest of the 90% energy is consumed for various metabolic processes like respiration, thermoregulation, osmoregulation, etc.

**2. The number of trophic levels in an ecosystem is limited. Comment.**
**Solution:**
After a few trophic levels, the energy becomes zero as the energy transferred from one level to another is 10 per cent and thus the trophic level succession stops and therefore, the number of trophic levels in an ecosystem are limited.

**3. Is an aquarium a complete ecosystem?**
**Solution:**
An aquarium consists of all the biotic components like bacteria, plants, small aquatic organisms, etc and abiotic components like water, light, temperature, oxygen in the water, non-living decoration, the filter, substrate, etc. Hence it is a complete ecosystem.

**4. What could be the reason for the faster rate of decomposition in the tropics?**
**Solution:**
In tropics, the soil will be rich in nutrients and there will be the presence of leaves and organic components which decomposes. Thus the rate of decomposition will be higher and faster.

**5. Human activities interfere with the carbon cycle. List any two such activities.**
**Solution:**
1. Deforestation of trees: One of the human activities which causes a rise in the carbon level by less production of oxygen and less consumption of carbon dioxide.
2. Rapidly burning of fossil fuels: The fossil fuels like coal, petroleum, etc are used for cooking and transport. These fossil fuels are burned and they emit carbon components.

**6. The flow of energy through various trophic levels in an ecosystem is unidirectional and non-cyclic. Explain.**
**Solution:**
The energy which receives from the sun cannot be passed back to the previous trophic level. Thus, it is only unidirectional and non-cyclic.

**7. Apart from plants and animals, microbes from 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 fulfil their energy requirements?**
**Solution:**
The Micro-organisms obtain their energy requirements from the organic matter which is obtained by dead and decaying animals and plants.

**8. Poaching of the tiger is a burning issue in today's world. What implication would this activity have on the functioning of the ecosystem of which the tigers are an integral part?**
**Solution:**
Poaching of tigers would lead to an imbalance in the natural ecosystem by the extinction of an organism. This would remove the predator species from the ecosystem and it will lead to an increase in the number of the tiger’s natural prey.

**9. In relation to energy transfer in the ecosystem, explain the statement "10kg of deer's meat is equivalent to 1 kg of lion's flesh".**
**Solution:**
Energy transfer in an ecosystem follows a ten per cent rule which states that 10% of energy is transferred to the next trophic level. So, if the lion eats 10 kg of deer meat then only 10% energy would be passed to the lion i.e., 1 kg of lion’s flesh.

**10. Primary productivity varies from ecosystem to ecosystem. Explain?**
**Solution:**
The primary productivity varies from ecosystem to ecosystem as it depends on the plant species and the environment surrounding and its ability to carry out photosynthesis.

**11. Sometimes due to biotic/abiotic factor, 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.**

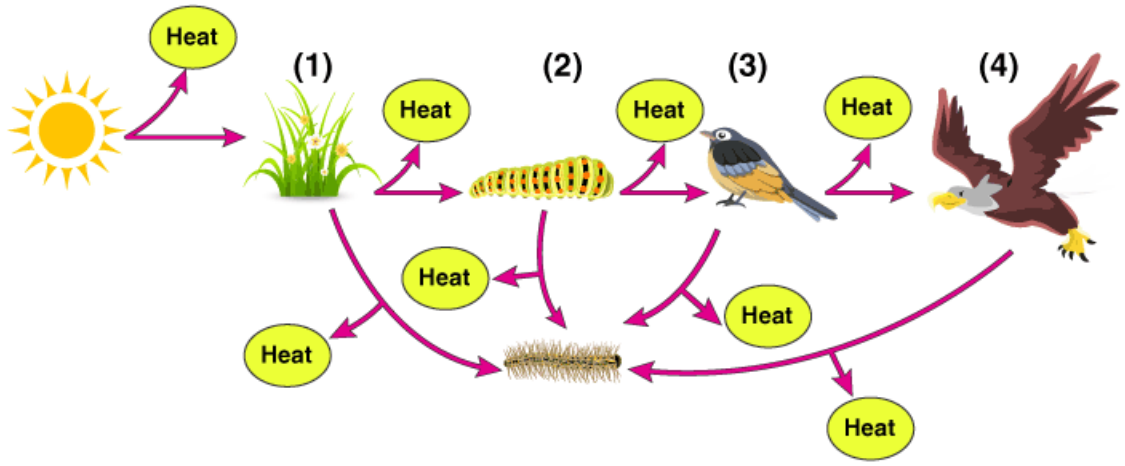
**Solution:**
Due to sudden climatic changes, sometimes the climax species form a pre-climax stage, abiotic and biotic factor affects the serial stage. An example is seeds and vegetative propagules.

**12. What is an incomplete ecosystem? Explain with the help of a suitable example.**
**Solution:**
The ecosystem in which either a biotic or abiotic factor is absent is called an incomplete ecosystem. An example is a benthic zone in which the bottom part of the water body where light isn't available.

**13. What are the shortcomings of ecological pyramids in the study of the ecosystem?**
**Solution:**
Ecological pyramids assume simple food chain and it does not take the same species belongs to two or more trophic levels. It does not accommodate the food web and there is no space for saprophytes.

**14. How do you distinguish between humification and mineralisation?**
**Solution:**
Humification: It involves the formation of the amorphous topmost layer of soil called the humus.
Mineralisation: Humus degrades to release inorganic nutrients.

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




**Solution:**
1) Producers
2) Primary consumers
3) Secondary consumers
4) Tertiary consumers (Topmost carnivore)

**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.**
**Solution:**
Always high temperature and high humidity favour the process of decomposition. Low pH reduces the

growth of decomposer microbes; therefore the process of decomposition slows down. Decomposition of detritus is due to the activity of 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 the same thing? If your answer is yes, give reasons. And if your answer is no, explain the meaning of each expression.**
**Solution:**
The meaning of the above statements is different. Each expression means a different meaning.
a. This statement signifies the total amount of wheat harvested by the farmer i.e., Only the quantity of the wheat is given but the area and time in which it is harvested are not given.
b. In this statement, only the yield is specified i.e. the total primary production of wheat by the farmer and area
c. This statement signifies the total primary production of wheat by the farmer and the area and period of its harvesting.

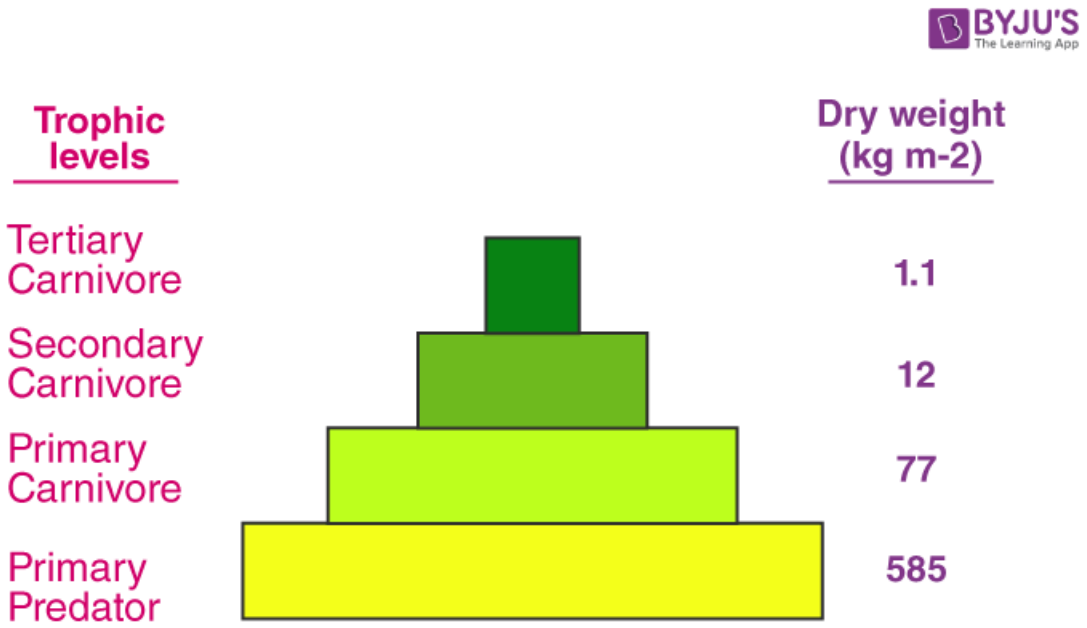
**2. Justify the following statement in terms of ecosystem dynamics. "Nature tends to increase the gross primary productivity, while man tends to increase the net primary productivity".**
**Solution:**
Gross Primary Productivity is defined as the rate of production of the organic matter during the photosynthesis in an ecosystem. It is utilized by the plants during respiration. GPP varies according to tp each tropic level. That is only 10 per cent will be the remaining of 100 per cent GPP. The plants 90percent of the GPP for their metabolic activities like respiration and so on. The GPP utilized by the plants minus the metabolic activities i.e., respiration losses (R) is defined as the net primary productivity (NPP). The ecosystem tends to increase the rate of Gross Primary Productivity (GPP) for producing more food from solar energy. Human tends to increase the Net Primary Productivity (NPP) to ensure that food is available for the human population.

**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 and alpine meadow.**
Solution:
From the above-given ecosystems, a young forest will be the most productive because primary productivity in an ecosystem depends upon the plant species in a given area and the rate of plant growth and the number of plants growing. When compared to the natural old forest the young forest has a higher rate of plant growth. A shallow polluted lake and alpine meadow have a lower number of producers and therefore they have less productivity.

**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?**
**Solution:**

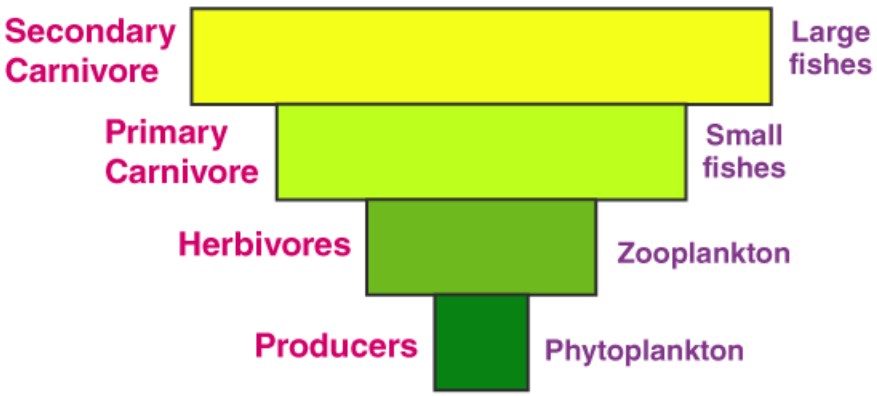
The three types of ecological pyramids are:
i) Pyramid of number: It is an ecological pyramid which indicates the number of individual organisms at each trophic level in an ecosystem. It can be either upright or inverted pyramid
ii) Pyramid of biomass: It is an ecological pyramid which indicates the amount of organic matter present at each trophic level in an ecosystem. It can be either upright or inverted pyramid
iii) Pyramid of energy: It is an ecological pyramid which gives the total amount of energy present at each trophic level in an ecosystem. It can be either upright or inverted pyramid.

**5. Write a short note on the pyramid of numbers and a pyramid of biomass.**
**Solution:**
1. Pyramid of numbers
It is an ecological pyramid which represents the number of individual organisms at each trophic level in an ecosystem.



Pyramid of biomass for grassland ecosystem

2. Pyramid of Biomass
It is an ecological pyramid which represents the amount of organic matter present at each trophic level in an ecosystem.




Inverted pyramid of numbers for marine ecosystem

**6. Given below is a list of autotrophs and heterotrophs. With your knowledge about the 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.**

**Solution:**

This linkage established is known as a food web, which is the interlocking between two or more types of the food chain at various tropic levels.

Primary Producer's (Tropic level I): Algae, Hydrilla, a maize plant, Phytoplankton, Nymphaea, and Spirogyra.

Primary Consumer (Tropic level II): Crustaceans, grasshopper, deer, mouse, squirrel, rabbit, elephant, goat.

Secondly Consumer (Tropic level III): Spider, cockroach, lizard, wolf, snake, toad, fish, and crane.

Top carnivore (Tropic level IV): Lion, Tiger. They are topmost carnivores.

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

**Solution:**

The second law of Thermodynamics states that energy can neither be created nor be destroyed; it can only be transformed from one form to another form. Energy flows in the ecosystem through the external environment to the series of organisms back again to the external environment. Only 10 per cent of the energy is transferred to the next tropic level. The utilized energy, later on, transforms into heat. Hence, ecosystems are not exempt from the Second Law of thermodynamics.

**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**
**Solution:**
a. If producers are removed then we can say the organisms are dead. There won't be primary productivity which comes zero. No biomass would be available for the next trophic levels.
b. All organisms of herbivore level are eliminated then organisms depending on herbivores (carnivores) will die. Producers would flourish and primary productivity would increase.
c. If all the top carnivores are removed it will result in the increase in the population of herbivore which would start to destroy producers and this will lead to ecological disbalance.

**9. Give two examples of artificial or manmade ecosystems. List the salient features by which they differ from natural ecosystems.**
**Solution:**
Man-made ecosystem: Crop fields and aquarium. The manmade ecosystem involves few organisms as compared to the natural ecosystem which leads to comparatively low productivity. In an artificial ecosystem, the maintenance will be artificially done by regular feeding and clearing the aquarium. Natural ecosystems are self-sustainable.

**10. The biodiversity increases when one moves from the pioneer to the climax stage. What could be the explanation?**
**Solution:**
The biodiversity increases when one moves from the pioneer to the climax stage. During ecological succession, a stage is reached at which all the biotic species are in a state of fine balance among themselves and with the abiotic condition.

**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 the reservoir located in earth's crust.**
**Solution:**
The cyclic movement of nutrients from their reservoirs to the plants and then back to the reservoir is called a biogeochemical cycle. This provides enough amount of nutrients to meet the deficit caused in the ecosystem due to influx and efflux. An example of the sedimentary cycle is Phosphorus cycle. The reservoir of P is present in rocks. As the rocks weather, it releases phosphate dissolved in soil solution. $PO_3^{4+}$ is present in the soil is absorbed by the plants. Herbivores and other organisms consume Phosphorus from plants. Again the phosphorus will get released into the soil when this organism dies or they release excreta. This cycle is repeated in this way.

**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 the P/R ratio of a pioneer community and the climax community?**
**Solution:**
P/R ratio refers to the Production/Respiration ratio, it represents the relationship between productivity and its consumption. For a stable community P/R ratio = 1.
For Pioneer species P/R >1, to establish a community organic matter is needed to be accumulated. For climax communities P/R=1. Climax communities being stable utilize all the products.