

# Chapter 36

## Ecosystem

- Which ecosystem has the maximum biomass?  
(a) Grassland ecosystem  
(b) Pond ecosystem  
(c) Lake ecosystem  
(d) Forest ecosystem *(NEET 2017)*
- The primary producers of the deep-sea hydrothermal vent ecosystem are  
(a) green algae  
(b) chemosynthetic bacteria  
(c) blue-green algae (d) coral reefs.  
*(NEET-II 2016)*
- Which of the following would appear as the pioneer organisms on bare rocks?  
(a) Mosses (b) Green algae  
(c) Lichens (d) Liverworts  
*(NEET-I 2016)*
- Which one of the following is a characteristic feature of cropland ecosystem?  
(a) Absence of weeds  
(b) Ecological succession  
(c) Absence of soil organisms  
(d) Least genetic diversity *(NEET-I 2016)*
- The term ecosystem was coined by  
(a) E. Haeckel (b) E. Warming  
(c) E.P. Odum (d) A. G. Tansley.  
*(NEET-I 2016)*
- Most animals that live in deep oceanic waters are  
(a) tertiary consumers (b) detritivores  
(c) primary consumers  
(d) secondary consumers. *(2015)*
- During ecological succession  
(a) the numbers and types of animals remain constant  
(b) the changes lead to a community that is in near equilibrium with the environment and is called pioneer community  
(c) the gradual and predictable change in species composition occurs in a given area  
(d) the establishment of a new biotic community is very fast in its primary phase. *(2015)*
- In which of the following both pairs have correct combination?
 

(a)	Gaseous nutrient cycle Sedimentary nutrient cycle	Nitrogen and Sulphur Carbon and Phosphorus
(b)	Gaseous nutrient cycle Sedimentary nutrient cycle	Sulphur and Phosphorus Carbon and Nitrogen
(c)	Gaseous nutrient cycle Sedimentary nutrient cycle	Carbon and Nitrogen Sulphur and Phosphorus
(d)	Gaseous nutrient cycle Sedimentary nutrient cycle	Carbon and Sulphur Nitrogen and Phosphorus

  
*(2015)*
- The mass of living material at a trophic level at a particular time is called  
(a) net primary productivity  
(b) standing crop  
(c) gross primary productivity  
(d) standing state. *(2015 Cancelled)*
- Vertical distribution of different species occupying different levels in a biotic community is known as  
(a) zonation (b) pyramid  
(c) divergence (d) stratification.  
*(2015 Cancelled)*
- Secondary succession takes place on/in  
(a) newly created pond  
(b) newly cooled lava

Ecosystem

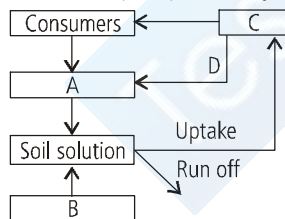
- (c) bare rock (d) degraded forest.  
(2015 Cancelled)

12. Most animals are tree dwellers in a  
(a) temperate deciduous forest  
(b) tropical rainforest  
(c) coniferous forest  
(d) thorn woodland. (2015 Cancelled)

13. In an ecosystem the rate of production of organic matter during photosynthesis is termed as  
(a) secondary productivity  
(b) net productivity  
(c) net primary productivity  
(d) gross primary productivity.  
(2015 Cancelled)

14. Match the following and select the correct option.
- |                      |                     |
|----------------------|---------------------|
| A. Earthworm         | (i) Pioneer species |
| B. Succession        | (ii) Detritivore    |
| C. Ecosystem service | (iii) Nataliy       |
| D. Population growth | (iv) Pollination    |
- |           |          |          |          |
|-----------|----------|----------|----------|
| <b>A</b>  | <b>B</b> | <b>C</b> | <b>D</b> |
| (a) (i)   | (ii)     | (iii)    | (iv)     |
| (b) (iv)  | (i)      | (iii)    | (ii)     |
| (c) (iii) | (ii)     | (iv)     | (i)      |
| (d) (ii)  | (i)      | (iv)     | (iii)    |
- (2014)

15. Given below is a simplified model of phosphorus cycling in a terrestrial ecosystem with four blanks (A-D). Identify the blanks.



	A	B	C	D
(a)	Rock minerals	Detritus	Litter fall	Producers
(b)	Litter fall	Producers	Rock minerals	Detritus
(c)	Detritus	Rock minerals	Producers	Litter fall
(d)	Producers	Litter fall	Rock minerals	Detritus

(2014)

16. If 20 J of energy is trapped at producer level, then how much energy will be available to peacock as food in the following chain?

- Plant → Mice → Snake → Peacock  
(a) 0.02J (b) 0.002J  
(c) 0.2J (d) 0.0002J (2014)

17. Natural reservoir of phosphorus is  
(a) rock (b) fossils  
(c) sea water (d) animal bones.  
(NEET 2013)

18. Secondary productivity is rate of formation of new organic matter by  
(a) consumers (b) decomposers  
(c) producers (d) parasites.  
(NEET 2013)

19. Which one of the following processes during decomposition is correctly described?  
(a) Catabolism – Last step in the decomposition under fully anaerobic condition  
(b) Leaching – Water soluble inorganic nutrients rise to the top layers of soil  
(c) Fragmentation – Carried out by organisms such as earthworm  
(d) Humification – Leads to the accumulation of a dark coloured substance humus which undergoes microbial action at a very fast rate.  
(NEET 2013)

20. Which two distinct microbial processes are responsible for the release of fixed nitrogen as dinitrogen gas (N<sub>2</sub>) to the atmosphere?  
(a) Aerobic nitrate oxidation and nitrite reduction  
(b) Decomposition of organic nitrogen and conversion of dinitrogen to ammonium compounds  
(c) Enteric fermentation in cattle and nitrogen fixation by *Rhizobium* in root nodules of legumes  
(d) Anaerobic ammonium oxidation and denitrification. (Karnataka NEET 2013)

21. Which of the following is a primary consumer in maize field ecosystem?  
(a) Grasshopper (b) Wolf  
(c) Phytoplankton (d) Lion  
(Karnataka NEET 2013)

22. When man eats fish which feeds on zooplanktons which have eaten small plants, the producer in this chain is

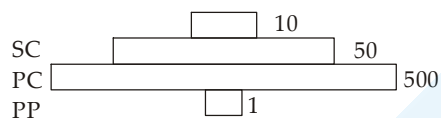
- (a) small plants (b) fish  
(c) man (d) zooplankton.  
(Karnataka NEET 2013)

23. Which one of the following is not a gaseous biogeochemical cycle in ecosystem?  
(a) Sulphur cycle (b) Phosphorus cycle  
(c) Nitrogen cycle (d) Carbon cycle  
(2012)

24. Identify the possible link "A" in the following food chain.

Plant → Insect → Frog → "A" → Eagle

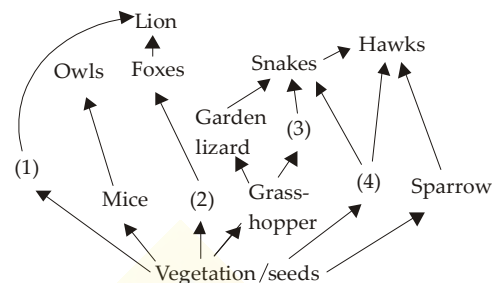
- (a) Rabbit (b) Wolf  
(c) Cobra (d) Parrot (2012)
25. Given below is an imaginary pyramid of numbers. What could be one of the possibilities about certain organisms at some of the different levels?



- (a) Level PC is "insects" and level SC is "small insectivorous birds".  
(b) Level PP is "phytoplanktons" in sea and "whale" on top level TC  
(c) Level one PP is "pipal trees" and the level SC is "sheep".  
(d) Level PC is "rats" and level SC is "cats".  
(2012)
26. Which one of the following is not a functional unit of an ecosystem?  
(a) Energy flow (b) Decomposition  
(c) Productivity (d) Stratification  
(2012)
27. The upright pyramid of number is absent in  
(a) pond (b) forest  
(c) lake (d) grassland. (2012)
28. The rate of formation of new organic matter by rabbit in a grassland, is called  
(a) net productivity  
(b) secondary productivity  
(c) net primary productivity  
(d) gross primary productivity. (Mains 2012)
29. The second stage of hydrosere is occupied by plants like

- (a) *Azolla* (b) *Typha*  
(c) *Salix* (d) *Vallisneria*.  
(Mains 2012)

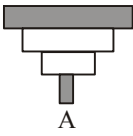
30. Identify the likely organisms (1), (2), (3) and (4) in the food web shown below.



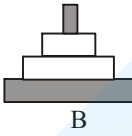
- | (1)          | (2)      | (3)      | (4)    |
|--------------|----------|----------|--------|
| (a) Deer     | Rabbit   | Frog     | Rat    |
| (b) Dog      | Squirrel | Bat      | Deer   |
| (c) Rat      | Dog      | Tortoise | Crow   |
| (d) Squirrel | Cat      | Rat      | Pigeon |
- (Mains 2012)

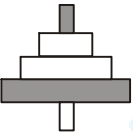
31. Mass of living matter at a trophic level in an area at any time is called  
(a) standing crop (b) detritus  
(c) humus (d) standing state.  
(2011)
32. Of the total incident solar radiation the proportion of PAR is  
(a) about 70% (b) about 60%  
(c) less than 50% (d) more than 80%.  
(2011)
33. Which one of the following statements is correct for secondary succession?  
(a) It begins on a bare rock.  
(b) It occurs on a deforested site.  
(c) It follows primary succession.  
(d) It is similar to primary succession except that it has a relatively fast pace. (2011)
34. Which one of the following statements for the pyramid of energy is incorrect?  
(a) Its base is broad.  
(b) It shows energy content of different trophic level organisms.  
(c) It is inverted in shape.  
(d) It is upright in shape. (2011)
35. Which one of the following animals may occupy more than one trophic levels in the same ecosystem at the same time?

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- (a) Sparrow (b) Lion  
(c) Goat (d) Frog (Mains 2011)
36. Both hydrarch and xerarch successions lead to  
(a) medium water conditions  
(b) xeric conditions  
(c) highly dry conditions  
(d) excessive wet conditions. (Mains 2011)
37. The breakdown of detritus into smaller particles by earthworm is a process called  
(a) humification (b) fragmentation  
(c) mineralisation (d) catabolism. (Mains 2011)
38. The biomass available for consumption by the herbivores and the decomposers is called  
(a) net primary productivity  
(b) secondary productivity  
(c) standing crop  
(d) gross primary productivity. (2010)
39. Which of the following representations shows the pyramid of numbers in a forest ecosystem?
- 

A



B
- 

C



D
- (a) D (b) A  
(c) B (d) C (Mains 2010)
40. The correct sequence of plants in a hydrosere is  
(a) *Volvox* → *Hydrilla* → *Pistia* → *Scirpus* → *Lantana* → Oak  
(b) *Pistia* → *Volvox* → *Scirpus* → *Hydrilla* → Oak → *Lantana*  
(c) Oak → *Lantana* → *Volvox* → *Hydrilla* → *Pistia* → *Scirpus*  
(d) Oak → *Lantana* → *Scirpus* → *Pistia* → *Hydrilla* → *Volvox*. (2009)
41. Which one of the following types of organisms occupy more than one trophic level in a pond ecosystem?

- (a) Fish (b) Zooplankton  
(c) Frog (d) Phytoplankton (2009)
42. Consider the following statements concerning food chains.  
A. Removal of 80% tigers from an area resulted in greatly increased growth of vegetation.  
B. Removal of most of the carnivores resulted in an increased population of deers.  
C. The length of food chains is generally limited to 3-4 trophic levels due to energy loss.  
D. The length of food chains may vary from 2 to 8 trophic levels.  
Which two of the above statements are correct?  
(a) A, D (b) A, B  
(c) B, C (d) C, D (2008)
43. The slow rate of decomposition of fallen logs in nature is due to their  
(a) anaerobic environment around them  
(b) low cellulose content  
(c) low moisture content  
(d) poor nitrogen content. (2008)
44. About 70% of total global carbon is found in  
(a) oceans (b) forests  
(c) grasslands (d) agroecosystems. (2008)
45. Which one of the following ecosystem types has the highest annual net primary productivity?  
(a) Tropical deciduous forest  
(b) Temperate evergreen forest  
(c) Temperate deciduous forest  
(d) Tropical rainforest (2007)
46. Which one of the following is not used for construction of ecological pyramids?  
(a) Fresh weight (b) Dry weight  
(c) Number of individuals  
(d) Rate of energy flow (2006)
47. Which of the following is expected to have the highest value (gm/m<sup>2</sup>/yr) in a grassland ecosystem?  
(a) Secondary production  
(b) Tertiary production  
(c) Gross production (GP)  
(d) Net production (NP) (2004)

48. An ecosystem which can be easily damaged but can recover after some time if damaging effect stops will be having  
 (a) low stability and high resilience  
 (b) high stability and low resilience  
 (c) low stability and low resilience  
 (d) high stability and high resilience. (2004)
49. Bamboo plant is growing in a fir forest then what will be the trophic level of it?  
 (a) First trophic level ( $T_1$ )  
 (b) Second trophic level ( $T_2$ )  
 (c) Third trophic level ( $T_3$ )  
 (d) Fourth trophic level ( $T_4$ ) (2002)
50. Plant decomposers are  
 (a) monera and fungi (b) fungi and plants  
 (c) protista and animalia  
 (d) animalia and monera. (2001)
51. Which is the reason for highest biomass in aquatic ecosystem?  
 (a) Nano plankton, blue green algae and green algae  
 (b) Sea grass and slime moulds  
 (c) Benthic and brown algae  
 (d) Diatoms (2000)
52. Energy transfer from one trophic level to other, in a food chain, is  
 (a) 10% (b) 20%  
 (c) 1% (d) 2%. (1999)
53. In a terrestrial ecosystem such as forest, maximum energy is in which trophic level?  
 (a)  $T_3$  (b)  $T_4$   
 (c)  $T_1$  (d)  $T_2$  (1998)
54. The rate at which light energy is converted into chemical energy of organic molecules is the ecosystem's  
 (a) net secondary productivity  
 (b) gross primary productivity  
 (c) net primary productivity  
 (d) gross secondary productivity. (1998)
55. Which of the following ecosystem has the highest gross primary productivity?  
 (a) Mangroves (b) Rainforest  
 (c) Grassland (d) Coral reef (1997)
56. Which of the following acts as "nature's scavengers"?  
 (a) Insects (b) Microorganisms  
 (c) Man (d) Animals (1997)
57. The 10% energy transfer law of food chain was given by  
 (a) Lindemann (b) Tansley  
 (c) Stanley (d) Weismann. (1996)
58. If we completely remove the decomposers from an ecosystem, its functioning will be adversely affected, because  
 (a) mineral movement will be blocked  
 (b) the rate of decomposition will be very high  
 (c) energy flow will be blocked  
 (d) herbivores will not receive solar energy. (1995)
59. In a biotic community, the primary consumers are  
 (a) detritivores (b) herbivores  
 (c) carnivores (d) omnivores. (1995)
60. Which of the following pairs is a sedimentary type of biogeochemical cycle?  
 (a) Phosphorus and nitrogen  
 (b) Phosphorus and sulphur  
 (c) Oxygen and nitrogen  
 (d) Phosphorus and carbon dioxide (1995)
61. Which of the following is the most stable ecosystem?  
 (a) Mountain (b) Ocean  
 (c) Forest (d) Desert (1995)
62. The primary succession refers to the development of communities on a  
 (a) forest clearing after devastating fire  
 (b) newly-exposed habitat with no record of earlier vegetation  
 (c) freshly cleared crop field  
 (d) pond, freshly filled with water after a dry phase. (1995)
63. The dominant second trophic level, in a lake ecosystem, is  
 (a) phytoplankton (b) zooplankton  
 (c) benthos (d) plankton. (1994)
64. Pyramid of numbers deals with number of  
 (a) species in an area  
 (b) individuals in a community  
 (c) individuals in a trophic-level  
 (d) subspecies in a community. (1993)

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65. Pyramid of numbers in a pond ecosystem is  
(a) irregular (b) inverted  
(c) upright (d) spindle shaped. (1993)
66. Food chain in which microorganisms breakdown the food formed by primary producers is  
(a) parasitic food chain  
(b) detritus food chain  
(c) consumer food chain  
(d) predator food chain. (1991)
67. Pick up the correct food chain.  
(a) Grass → Chameleon → Insect → Bird  
(b) Grass → Fox → Rabbit → Bird  
(c) Phytoplankton → Zooplankton → Fish  
(d) Fallen leaves → Bacteria → Insect larvae (1991)
68. Pyramid of numbers in a grassland/tree ecosystem is  
(a) always inverted (b) always upright  
(c) both (a) and (b) (d) spindle-shaped. (1991, 1990)
69. Upper part of sea/aquatic ecosystem contains  
(a) plankton (b) nekton  
(c) plankton and nekton  
(d) benthos. (1988)
70. What is true of ecosystem?  
(a) Primary consumers are least dependent upon producers.  
(b) Primary consumers out-number producers.  
(c) Producers are more than primary consumers.  
(d) Secondary consumers are the largest and most powerful. (1988)
71. In an ecosystem, which one shows one-way passage?  
(a) Free energy (b) Carbon  
(c) Nitrogen (d) Potassium (1988)

Answer Key

1. (d) 2. (b) 3. (c) 4. (d) 5. (d) 6. (b) 7. (c) 8. (c) 9. (b) 10. (d)  
11. (d) 12. (b) 13. (d) 14. (d) 15. (c) 16. (a) 17. (a) 18. (a) 19. (c) 20. (d)  
21. (a) 22. (a) 23. (b) 24. (c) 25. (a) 26. (d) 27. (b) 28. (b) 29. (d) 30. (a)  
31. (a) 32. (c) 33. (b) 34. (c) 35. (a) 36. (a) 37. (b) 38. (a) 39. (c) 40. (a)  
41. (a) 42. (c) 43. (d) 44. (a) 45. (d) 46. (a) 47. (c) 48. (a) 49. (a) 50. (a)  
51. (c) 52. (a) 53. (c) 54. (b) 55. (b) 56. (b) 57. (a) 58. (a) 59. (b) 60. (b)  
61. (b) 62. (b) 63. (b) 64. (c) 65. (c) 66. (b) 67. (c) 68. (b) 69. (a) 70. (c)  
71. (a)

## EXPLANATIONS

1. (d)
2. (b) : Hydrothermal vents are cracks in the ocean floor that emit jets of hot water loaded with minerals and chemosynthetic bacteria. These bacteria are autotrophs that oxidise hydrogen sulphide in vent water to obtain energy which is used to produce organic material. These chemosynthetic bacteria are the primary producers and form the base of vent food webs. All vent animals ultimately depend on bacteria for food.
3. (c) : The bare rocky habitat is extremely hostile to living beings. There is no water, as the substratum does not absorb rain water. There is no nutrient holding mechanism. Plants cannot grow on these rocks. The first inhabitants or pioneers of such a habitat are usually lichens as they are resistant to desiccation and extreme temperatures.
4. (d) : Cropland ecosystem is an artificial or man-made terrestrial ecosystem which is created and maintained by human beings for their maximum benefits. Therefore, they will have least genetic diversity.
5. (d) : The term ecosystem was coined by A.G. Tansley in 1935.
6. (b) : Benthos is the community of organisms which live on, in, or near the sea bed, also known as the benthic zone. As no light is available at this zone of sea, the energy source for deep benthic ecosystems is often organic matter from higher up in the water column which drifts down to the depths. This dead and decaying matter sustains the benthic organisms, and therefore, most organisms in benthic zone *i.e.*, in deep oceanic waters, are scavengers or detritivores.
7. (c) : Biotic or ecological succession is the natural development of a series of biotic communities at the same site, one after the other till a climax community develops which does not change further because it is in perfect harmony with the environment of the area. The change is orderly and sequential. There is a parallel change in the physical environment.  
During an ecological succession, the number and types of animals goes on increasing with time. The community that is in near equilibrium with the environment is called climax community. The establishment of a new biotic community is slow in its primary phase but gradually becomes fast in its secondary phase.
8. (c) : Biogeochemical cycles are of two types: gaseous and sedimentary. In gaseous nutrient cycles, the materials involved in circulation between biotic and abiotic components of biosphere are gases or vapours and the reservoir pool is atmosphere or hydrosphere, *e.g.*, carbon, hydrogen, oxygen, nitrogen, water. In sedimentary nutrient cycles, materials involved in circulation between biotic and abiotic components of biosphere are non-gaseous and the reservoir pool is lithosphere, *e.g.*, phosphorus, calcium, magnesium. Sulphur has both sedimentary and gaseous nutrient cycles.
9. (b) : Standing crop is the total amount of living material in a specified population at a particular time, expressed as biomass (standing biomass) or its equivalent in terms of energy. The standing crop may vary at different times of the year; for example, in a population of deciduous trees between summer and winter.
10. (d)
11. (d) : Secondary succession (subseres) is the biotic succession that occurs in an area which become secondarily bare due to the destruction of community previously present there. Secondary succession starts from previously built up substrata with already existing living matter. The action of any external force, such as a sudden change in climatic factors, biotic intervention, fire, etc., had resulted in the destruction of previous community. Thus, area became devoid of living matter but its substratum, is built up. It has organic matter, so is biologically fertile and thus the successions are comparatively more rapid.
12. (b) : Tropical rainforests have a very dense plant cover. They also experience a large amount of precipitation, thus the forest floor is always damp. Thus, the conditions there have led animals to get adapted to arboreal habitats. Most animals found there are tree dwellers as almost every space on the forest floor is occupied by the vegetation.
13. (d) : The amount of energy accumulation in green plants as biomass or organic matter per unit area over a time period is known as primary productivity. The rate of total capture of energy, or the rate of total production of organic material (biomass), is known as gross primary productivity.
14. (d)
15. (c)





**30. (a)**

**31. (a) :** Refer to answer 9.

**32. (c) :** The source of energy in all ecosystem is solar energy. About 50% of the solar energy incident over earth is present in PAR (Photosynthetically active radiation). About 1–5% of incident solar radiation or 2 – 10% of PAR is captured by the photosynthetic organisms in the synthesis of organic matter (gross primary productivity). Roughly 20% of it is consumed in respiration so that net capture of energy (net primary productivity) is 0.8 – 4% of incident radiation or 1.6 – 8% of PAR.

**33. (b) :** Secondary succession begins in areas where natural biotic communities have been destroyed such as in abandoned farm lands, burned or cut forests (deforested site), lands that have been flooded etc.

**34. (c) :** Pyramid of energy is always upright, can never be inverted, because when energy flows from a particular trophic level to the next trophic level, some energy is always lost as heat at each step.

**35. (a) :** Sparrow can be herbivorous (eating seeds and fruits) or carnivorous (eating insects).

**36. (a) :** Hydrarch succession takes place in wetter areas and the successional series progress from hydric to the mesic condition . Xerach succession takes place in dry areas and the series progress from xeric to mesic condition. Hence, both hydrach and xerach succession leads to medium water conditions (mesic).

**37. (b) :** Refer to answer 19.

**38. (a) :** The total organic matter synthesised by the producers in the process of photosynthesis per unit time and area is known as gross primary productivity. Net primary productivity is equal to the rate of organic matter created by photosynthesis minus the rate of respiration and other losses. It is actually the biomass available for consumption by the herbivores and the decomposers.

**39. (c) :** The representation of forest ecosystem in pyramid of numbers is always upright because higher trophic level comprising of tertiary consumers is generally smaller than that of the lower trophic levels (*i.e.*, secondary consumer, than primary consumer and primary producer).

The pyramid of number is inverted in case of single tree producer which can provide nourishment to several herbivores such as birds which can further support larger population of ectoparasites.

**40. (a) :** Hydrosere, originating in water (pond, pools, lakes etc.) and starts with the colonization of some phytoplanktons which form the pioneer plant community, and finally terminates into a forest, which is a climax community together with their chief components of vegetation.

The various stages together with their components of plant species of a hydrosere are phytoplankton stage, rooted submerged stage, rooted floating stage, reed swamp stage, marsh or sedge meadow stage, woodland stage and climax forest stage. *Volvox* is phytoplankton, *Hydrilla* is rooted submerged plant, *Pistia* is rooted floating plant, *Scirpus* is reed swamp plant, *Lantana* is sedge meadow plant and oak is woody tree.

**41. (a) :** A single species may occupy more than one trophic level. In pond, fish occupy more than one trophic level. Small fishes act as secondary consumer. They feed on primary consumer. Large fishes act as tertiary consumer. They feed on smaller fish.

**42. (c) :** Removal of 80% tigers (*i.e.*, tertiary consumer) from an area resulted in decreased growth of vegetation because there will be increased numbers of secondary or primary consumers which feeds on green plant. Removal of most of the carnivores resulted in an increased population of deers on which carnivores depends. The length of food chain is generally limited to 3-4 trophic level due to energy loss because all the food available at one level is neither eaten nor used by animals at the next level and a lot of the energy is lost in respiration to drive the organisms metabolism so less energy is left to support higher trophic level.

**43. (d) :** Decomposition is largely an oxygen-requiring process. The rate of decomposition is controlled by chemical composition of detritus and climatic factors. In a particular climatic condition, decomposition rate is slower if detritus is rich in lignin and chitin, and quicker, if detritus is rich in nitrogen and water-soluble substances like sugar. Temperature and soil moisture are the most important climatic factors that regulate decomposition through their effects on the activities of soil microbes. Warm and moist environment favour decomposition whereas low temperature and anaerobiosis inhibit decomposition resulting in build up of organic materials.

**44. (a) :** Carbon constitutes 49% of dry weight of organism and is next only to water. Among the total quantity of global carbon 71% is found in oceans

## Ecosystem

in dissolved form whereas only 1% is found in atmosphere. Carbon cycling occurs through atmosphere, ocean and living or dead organism.

**45. (d) :** Net primary productivity is the total organic matter stored by producers per unit area per unit time. Gross primary productivity is the total organic matter synthesised by producers in the process of photosynthesis per unit area per unit time. So,

$$\text{Net primary productivity} = \text{Gross productivity} - \text{Respiration and other losses}$$

Tropical rainforests occur over equatorial/subequatorial regions with abundant warmth and rainfall. Diversity and productivity are maximum as compared to other regions.

**46. (a) :** Ecological pyramids represents the trophic structure and trophic function of an ecosystem. In an ecological pyramid, the first trophic level forms the base and successive trophic levels the tiers which make up the apex. Ecological pyramids may be of three general types pyramid of number, pyramid of biomass and pyramid of energy. Pyramid of biomass *i.e.* the living weight of the organisms of the food chain present at any time in an ecosystem forms the pyramids of biomass. The pyramid of biomass indicates the decrease or the gradual reduction in biomass at each trophic levels from base to apex. Fresh weight is not used in ecological pyramids.

**47. (c) :** Productivity is rate of accumulation of energy containing organic matter by an ecosystem per unit area per unit time. It is of two types- primary and secondary.

Productivity at producers level is known as primary productivity. It is two types: Gross primary productivity is primary productivity including that amount which is utilized in respiration and other metabolic activities. Net primary productivity (NPP) is primary productivity in excess to that which is utilised in respiration and other metabolic activities.

$$\text{NPP} = \text{GP} - \text{Respiration}$$

Secondary productivity is productivity at consumers level. Since gross production includes total production including the amount utilized in respiration and other metabolic activities so it is more than other forms of productivity.

**48. (a) :** Stability can be defined as the power of a system to be in their state against unfavourable factors and resilience is the capability of regaining its original shape or position after being deformed. An ecosystem can be damaged easily and it must be having high resilience.

**49. (a) :** Trophic structure of ecosystem is a type of producer-consumer arrangement, in which each food level is called trophic level and the graphical representation of trophic structure of ecosystem constitutes ecological pyramids. The green plants are producers and represent the first trophic level ( $T_1$ ). So bamboo plant is the first trophic level ( $T_1$ ).

**50. (a) :** Microorganisms (bacteria and fungi) are decomposers of the ecosystem. They feed upon dead decaying living organisms (both plant and animals) and break them into simpler compounds. These are released free in the atmosphere and are utilized by producers for the synthesis of their food materials. They mainly belong to monera and fungi.

**51. (c) :** The benthic region includes all the sea floor from the wave-washed shore-line to the greatest depths. Depending upon the penetration of light it is subdivided into two main zones: the lighted or littoral zone and the deep sea system. Due to abundance of light, water, oxygen, carbon dioxide and less salinity of water, the tidal zone is characterized by exorbitant growth of plants. The dense growth of vegetation, on the other hand, provides shelter and food for animals. A wide variety of algae, few grasses and animals of every phylum of animal kingdom are represented in this region.

**52. (a) :** Refer to answer 16.

**53. (c) :** In a terrestrial ecosystem maximum energy is in trophic level I because the organisms which trap solar energy are primary producers and they have got maximum energy. Only 10% energy is transferred from one trophic level to next trophic level.

**54. (b)**

**55. (b) :** Gross primary productivity is the total rate of photosynthesis, including the organic matter used up in respiration during the measurement period. Tropical evergreen/rainforests occur over equatorial/subequatorial regions with abundant warmth and rainfall (200–350 cm/yr) almost throughout the year. The forests are impenetrable (= jungle) with maximum diversity, *e.g.*, 200 types of trees in one hectare, 70–80% of all insects 80–85% of all birds. Productivity is maximum here, 12000 kcal/m<sup>2</sup>/yr.

**56. (b) :** Microorganisms (bacteria and mould) are decomposers of the ecosystem. They feed upon dead decaying organisms (both plant and animals) and break them into simpler compounds. These are released free in the atmosphere and are utilized by producers for the synthesis of their food materials. They are called nature's scavengers as they are consumers of dead matter.

57. (a) : Refer to answer 16.

58. (a) : Decomposers are saprotrophs which decompose the organic remains by secreting extracellular digestive enzymes. They are also known as mineralisers as they release minerals trapped in organic remains. So in the absence of microorganisms the flow of minerals will stop.

59. (b)

60. (b) : Refer to answer 8.

61. (b) : Of all the ecosystems, ocean is the largest and most stable ecosystem. Aquatic life is protected from vigorous climates and weather that are climatic conditions, problem of water supply, food, fire and artificial forces such as industrialization, farming and grazing are lacking in the oceans. The sea is continuous and not separated as land and freshwater habitats.

62. (b) : When succession begins on an area which has not been previously being occupied by a community, e.g., a new exposed rock area, sand dunes, new islands, deltas, shore or recent lava flow, it is known as primary succession. The first group of organisms (plants or animals) which become established in such an area is termed the pioneer community.

63. (b) : Trophic level is a step or division of food chain which is characterized by the method of obtaining its food. The two fundamental trophic levels are producers and consumers. Producers belong to the first trophic level. In a lake the producers are mainly some rooted or floating plants and phytoplanktons.

Primary consumers form the second trophic level. They feed on living plants or plant parts. The primary consumers are zooplanktons.

64. (c) : Pyramid of numbers is an ecological pyramid which employs the number of individuals per unit area at various trophic levels sequence wise with producers at the base and various consumers at successively higher levels. Pyramid of number assumes different shapes in different ecosystems. The pyramid of number in pond ecosystem is also upright. In forest ecosystem the pyramid of number is intermediate. Here, the number of primary consumers is more than producers as well as top consumers. In parasitic food chain the pyramid of number is inverted.

65. (c) : Refer to answer 64.

66. (b) : The dead organic matter of plants or animals is called as detritus. While a part of it remains

on the soil surface as litter, the other part enters the soil. Many animals such as protozoans, nematodes, insects etc., depend on detritus and hence they are called as detritivores. Even the human beings are detritivores when they eat cooked food. From detritus, the chain proceeds to detritivores, then to carnivores and finally to top carnivores.

67. (c) : The process of transfer of energy from producers through a series of organisms, i.e., from primary consumers to secondary consumers and from secondary consumers to tertiary consumers by process of eating and being eaten constitute a food chain. The correct food chain is :

Phytoplankton → Zooplankton → Fish

68. (b) : Pyramid of numbers in a grassland/tree ecosystem is always upright. It shows the number of individual organisms at each level. In a grassland, the producers, which are mainly grasses, are always maximum in number. This number then shows a decrease towards apex, primary consumers are lesser in number than the grasses; the secondary consumers are lesser in number than the primary consumers. Finally, the top consumers are least in number. Thus, the pyramid becomes upright.

69. (a) : Planktons are passively floating in upper water, nektons are actively swimming while benthos lead sedentary life upon the sea bottom. Planktons are producers and are present in large number.

70. (c) : An ecosystem may be defined as a structural and functional unit of the biosphere comprising living organisms and their non-living environment that interact by means of food chains and chemical cycles resulting in energy flow, biotic diversity and material cycling to form a stable, self supporting system.

The organisms in an ecosystem are classified into 3 main categories-producers, consumers and decomposers. The consumers utilise materials and energy stored by the producers. Decomposers obtain their food molecules from the organic materials of dead producers and consumers. In a true ecosystem, producers are more than consumers (herbivores and carnivores).

71. (a) : The behaviour of energy in ecosystem can be termed energy flow due to unidirectional flow of energy. Flow of energy is only in one direction i.e., from solar radiation → producers → herbivores → carnivores.

This energy cannot pass in the reverse direction. There is decrease in the content and flow of energy with rise in trophic level.

