CHAPTER › 14

Ecosystem

NEET KEY NOTES

- Ecosystem is a functional unit of nature, where living organisms interact among themselves and also with their surrounding physical environment.
- The term ecosystem was coined by **AG Tansley** (1935). An ecosystem varies greatly in size from a small pond to a large forest or a sea.
- It is convenient to divide ecosystem into two categories
  - **Terrestrial**, e.g. forest, grassland and desert.
  - **Aquatic**, e.g. pond, lake, wetland, river and estuary ecosystems.
    Crop fields and an aquarium are the examples of man-made ecosystems.

Components of an Ecosystem

The ecosystem consists of the following components

- **Biotic components** These are comprised of animals, plants and microorganisms and have the following main parts
  - **Producers** The green plants which make their own food by photosynthesis are called producers, e.g. all green plants and green algae.
  - **Consumers** All heterotrophic animals obtain their food from green plants directly or indirectly. These are divided into two categories **herbivores and carnivores**. For example, rabbit, rat, squirrel, goat, cattle, etc., are herbivore and birds, hawk, snake, fox, etc., are carnivore animals.
  - **Consumers** are of three types– primary, secondary and tertiary.
    Omnivores are eat both producers and consumers, e.g. pig, bear, etc.
    Detritivores are depend on dead and decaying organic matter for obtaining their food, e.g. vultures, earthworm.
  - **Decomposers** are obtain their food by decaying dead organic matter, e.g. bacteria and fungi. These are also called **saprobes** or **mineralisers**.
- **Abiotic components** These include temperature, water, light and soil.

Ecosystem : Structure and Functions

- Interaction of biotic and abiotic components results in physical structure that is calculated by the characteristic of each type of ecosystem.
- The two important structural features of an ecosystem are
  - **Species composition** It is calculated by the identification and enumeration of plant and animal species of an ecosystem.
  - **Stratification** It is the vertical distribution of different species occupying different levels in an ecosystem, e.g. trees occupy top vertical strata or layer of a forest, shrubs the second and herbs and grasses occupy the bottom (third) layers.
- The important functional aspects of an ecosystem are

  (i) Productivity (ii) Decomposition
  (iii) Energy flow (iv) Nutrient cycling
- To understand the concept of an aquatic ecosystem, let us take a small pond ecosystem as an example.

Pond Ecosystem

- A pond is fairly a self-sustainable unit, that explains even the complex interactions that exist in an aquatic ecosystem. It is a shallow water body in which all the above mentioned basic structural and functional components are present.

- The pond water (abiotic component) contains all the dissolved inorganic and organic materials and soil deposited at its bottom. The solar input, the cycle of temperature, day-length and other climatic conditions regulate the rate of function of the entire pond.
- Autotrophic components are phytoplanktons, some algae and the floating, submerged and marginal plants found at the edges.
- **Consumers** are zooplanktons, which are free swimming and bottom dwellers.
- **Decomposers** are the fungi, bacteria and flagellates found abundantly in the bottom of the pond.
- This pond system performs all the functions of an ecosystem and of the biosphere as a whole, i.e. **autotrophs** convert inorganic materials into organic material with the help of solar energy, **heterotrophs** consume autotrophs and **decomposers** decompose and mineralise dead organic materials to release them back for reuse by the autotrophs.
- These events are repeated over and over again, however energy flow is unidirectional towards the higher trophic levels. At each trophic level, a part of energy is dissipated and is lost as heat to the environment.

Productivity

The rate of synthesis of biomass by any trophic level per unit area in unit time is called its **productivity.** It is expressed in terms of $gm^{-2} yr^{-1}$ or (Kcal m^{-2}) yr^{-1}.

- Productivity of an ecosystem can be categorised as **primary** and **secondary** productivity.
- **Primary production or productivity** It is the amount of biomass or organic matter produced per unit area over a time period by plants during photosynthesis. It is expressed in terms of weight (gm^{-2}) or energy (Kcal m^{-2}).
  - The total sum of organic matter synthesised by primary producers *via* photosynthesis is called **Gross Primary Productivity** (GPP).
  - The organic matter/energy stored by the primary producers after utilisation of some energy for respiration is called **Net Primary Productivity** (NPP). It is a part of gross primary productivity.

    Net Primary Productivity (NPP) =

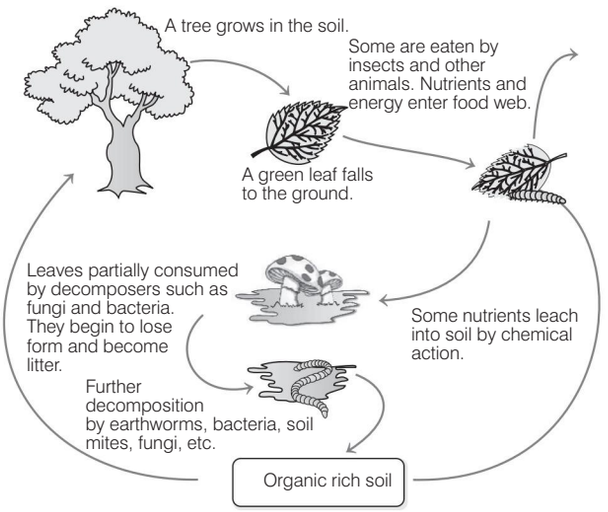
    Gross Primary Productivity (GPP)

    – Respiratory loss by plants (*R*).
- **Secondary productivity** It is the rate of new organic matter synthesised by the consumers. It is smaller than primary productivity and tends to decrease with an increase in trophic level.

  Ecological efficiency is the amount of energy received by one trophic level from the other in an ecosystem.

Decomposition

- It is the process of breaking down of complex organic matter into inorganic substances like water, carbon dioxide and nutrients by decomposers.
- **Detritus** is the raw material for the decomposition process.
- Decomposition involves following steps during its process
  - **Fragmentation** It is a process of breakdown of detritus into small particles by **detritivores**, e.g. earthworm.
  - **Leaching** It is the process by which water soluble inorganic nutrients reach into soil horizon and get precipitated as unavailable salts.
  - **Catabolism** It is the process of degradation of detritus into simple organic material by the action of bacterial and fungal enzymes and then their further conversion into simpler inorganic compounds.
  - **Humification** It is a process that leads to accumulation of a dark coloured amorphous and colloidal substance called **humus**, which is highly resistant to microbial action and undergoes decomposition at a very slow rate.
  - **Mineralisation** It is the process of degradation of humus by microbial action and releases of inorganic nutrients.



Diagrammatic representation of decomposition cycle in a terrestrial ecosystem

- Factors affecting decomposition are as follows
  - **Chemical decomposition of detritus** Decomposition is slow, if detritus is rich in lignin and chitin, but it will quicker if detritus is composed of nitrogen and sugar.
  - **Climatic factors** Temperature and soil moisture are the most important climatic factors.

Energy Flow

- Sun is the only source of energy for all the ecosystems on earth, except for deep sea hydrothermal ecosystem. Of all the total incident solar energy, less than 50% is **Photosynthetically Active Radiation** (PAR). Plants utilise only 2-10% of PAR to sustain the entire living world.
- Plants as well as photosynthetic and chemosynthetic bacteria (autotrophs) fix sun's radiant energy to make food from simple inorganic molecules. Thus, all organisms are dependent on producers either directly or indirectly for their food.
- The flow of energy is unidirectional, i.e. it flows from the sun to producers and then to consumers and thus, maintains the **first law of thermodynamics**.
- Further, there is a constant need of supply of energy to synthesise the molecules, the ecosystem requires to counteract the universal tendency towards increasing disorderliness. This is in correlation with **second law of thermodynamics**.
- No energy that is trapped into an organism remains in it forever. The energy trapped by the producer, is either passed on to a consumer or the organism dies.
- The consumers may be of following types
  - **Primary consumers** The consumers that feed on plants directly, are called primary consumers or **herbivores**.
  - **Secondary consumers** Those animals, which eat other animals, who eat plants are called secondary consumers. These are also referred to as **primary carnivores.**
  - **Tertiary consumers** These are animals who feeds on secondary consumers for their nutrition. These are also referred to as **secondary carnivores**.
    Therefore, due to this interdependence of food/energy between organisms, the chains or webs are formed in the ecosystem.

Food Chain

- The transfer of energy from green plants through a sequence of organisms, in which each eats the one below it in the chain and is eaten by the one above is called a **food chain**. It is actually a feeding chain of organisms in an ecosystem.
- The food chain present in nature is of two types
  - **Grazing Food Chain** (GFC) begins with producers which capture solar energy and pass on energy into food chain through photosynthesis, e.g.

    Grass → Goat → Man
    (Producer) (Primary consumer) (Secondary consumer)
  - **Detritus Food Chain** (DFC) begins with dead organic matter and consists of decomposers mainly **fungi** and **bacteria**, e.g.

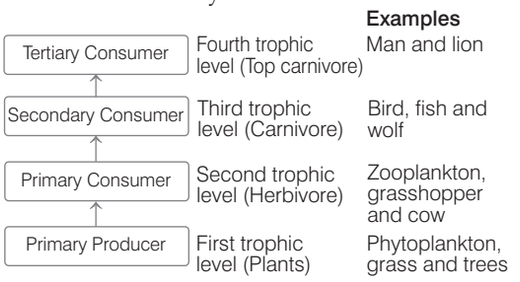
    Dead leaves → Wood louse → Black bird
    (Producer) (Primary consumer) (Secondary consumer)

Food Web

A network of cross connecting food chains involving producers, consumers and decomposers are termed as a **food web**. It maintains a kind of homeostasis in an ecosystem to make it stable.

Trophic Level

- Organisms occupy a place in the natural surrounding according to their feeding relationship with other organisms. This forms a hierarchy in a food chain called as **trophic level**. The following diagram shows the various trophic levels in an ecosystem.



Flow chart representation of trophic levels in an ecosystem

Each trophic level has a certain mass of living material at a particular time called as the **standing crop**. The standing crop is measured as the mass of living organisms (**biomass**) or the number in a unit area.

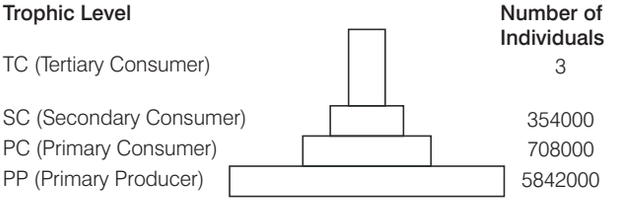
Organisms at each trophic level depend on those at the lower trophic level for their energy demands.

The number of trophic levels in the grazing food chain is restricted, as the transfer of energy follows **10% law**. It means only 10% of the energy is transferred to each trophic level from the lower trophic level. It was given by **Lindemann** in 1942.

Ecological Pyramids

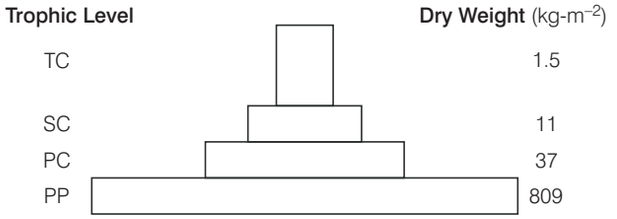
The trophic structure of an ecosystem is represented in the form of ecological pyramids. The base of each pyramid represents the producers or the first trophic level, while the apex represents tertiary or top level consumer. The three types of ecological pyramids are

- **Pyramid of number** It shows relationship between producers and consumers in an ecosystem in terms of numbers.

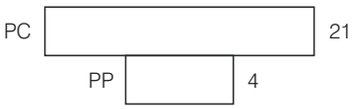


Pyramid of numbers in a grassland ecosystem

- **Pyramid of biomass** It shows relationship between producers and consumers in an ecosystem terms of biomass. It can be
  - **Upright**, e.g. in case of grass land ecosystem.
  - **Inverted**, e.g. in case of pond ecosystem.

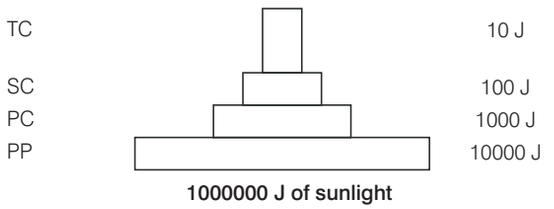


Upright pyramid of biomass shows a sharp decrease in biomass at higher trophic levels



Inverted pyramid of biomass. Small standing crop of phytoplankton supports large standing crop of zooplankton

- **Pyramid of energy** It is the relationship between producers and consumers in an ecosystem in terms of 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 in the sunlight available to them into NPP.

- **Limitations of Ecological Pyramids**
  - It includes a simple food chain which never exists in nature.
  - It never keeps an account of the same species belonging to two or more trophic levels.
  - It spite of the vital role played by saprophytes/ decomposers, they are not given any position in ecological pyramids.

Ecological Succession

- It is a sequential, gradual and predictable change in the species composition of a given area.
- The entire sequence of communities that successively change in a given area are called **sere(s)**.
- The individual transitional communities are termed as **seral stages** or **seral communities**.
- In the successive seral stages, there is a change in the diversity of species of organisms, increase in the number of species and organisms as well as an increase in the total biomass.
- These changes lead finally to a community that is near equilibrium with the environment and called a **climax community**. Ecological succession can be of two types
  - **Primary succession** begins in areas, where no living organisms ever existed, e.g. newly cooled lava, bare rock, newly created pond or reservoir. It starts with pioneers species (i.e. the first ones to invade a bare area) like lichens on rocks.
  - **Secondary succession** begins in areas, where natural biotic communities have been destroyed such as in abandoned farm lands, burned or cut forests, lands that have been flooded. Since, some soil or sediment is present, succession is faster than primary succession.

Succession of Plants

- Based on the nature of the habitat, whether it is water (or very wet area) or it is on very dry area, there are two types of successions

Hydrarch Succession

- It takes place in wetter areas and the successional series progress from hydric to the mesic conditions.
- During primary succession in water, pioneer species are the small phytoplanktons.
- These phytoplanktons are replaced with time by free-floating angiosperms, then by rooted hydrophytes, sedges, grasses and finally the establishment of trees occurs.
- At last, formation of stable climax forest takes place, i.e. with time the water body is converted into land.

Xerarch Succession

- It takes place in dry areas and the series progress from xeric to mesic conditions.
- Lichens are the pioneer species in the primary succession on rocks as they secrete acids that dissolve rocks helping in weathering and soil formation.
- Later, small plants like bryophytes emerged which are able to take hold in the small amount of soil.
- These bryophytes, with time were succeeded by bigger plants. After several more stages of successions, ultimately a stable climax forest community tends to form.
- The climax community remains stable as long as the environment remains unchanged. In this way, xerophytic habitat gets completely converted into a mesophytic one.
- Both hydrarch and xerarch succession lead to medium water conditions (mesic), neither too dry (xeric) nor too wet (hydric). The important fact is that all successions whether taking place in water or on land, proceed to a similar **mesic climax community**.

Nutrient Cycle

- The movement of nutrient elements through the various components of an ecosystem is called nutrient cycling or biogeochemical cycles.
- The amount of nutrients present in the soil at any given time, is referred to as the **standing state**. It varies in different kinds of ecosystems and also on a seasonal basis.
- Nutrient cycles are of two types
  - Gaseous
  - Sedimentary
- Atmosphere is the reservoir for **gaseous type of nutrient cycle** (e.g. nitrogen and carbon cycle).
- Earth's crust is the reservoir of **sedimentary cycle** (e.g. sulphur and phosphorus cycle).

Ecosystem–Carbon Cycle

- It occurs through atmosphere, ocean and through living and dead organisms.
- A large amount of carbon returns to the atmosphere as CO_2 through respiratory activities or the producers and consumers; breakdown activities of decomposers, forest fire; combustion of organic matter, etc.

Ecosystem–Phosphorus Cycle

- Phosphorus is a major constituent of biological membranes, nucleic acids, cellular energy transfer systems (ATP) and also of shells, bones and teeth.
- The natural reservoir of phosphorus is rock which contains phosphorus in the form of phosphates.
- The waste products and the dead organisms are decomposed by phosphate solubilising bacteria releasing phosphorus.

Ecosystem Services

- The products of ecosystem processes are termed as **ecosystem services**.
- Forests are the major sources of ecological services. These are in purification of air and water, mitigating droughts and floods, cycling nutrients, generating fertile soils, providing wildlife habitat, maintenance of biodiversity, pollination of crops, providing storage site for carbon, providing aesthetic, cultural and spiritual values.
- **Robert Constanza** and his colleagues tried to put price tags on nature's life support services, i.e. about US $ 33 trillion a year.

Mastering NCERT

MULTIPLE CHOICE QUESTIONS

TOPIC 1 ~ *Ecosystem–Structure and Function, Productivity and Decomposition*

1 A functional unit of nature, where living organisms interact among themselves and also with the surrounding physical environment is
(a) biosphere (b) ecosystem
(c) environment (d) None of these

2 The term ecosystem was coined by ***NEET 2016***
(a) AG Tansley (b) E Haeckel
(c) E Warming (d) EP Odum

3 The basic categories of ecosystem are
(a) aquatic (b) terrestrial
(c) Both (a) and (b) (d) grassland and crop field

4 Which of the following is an example of man-made ecosystem?
(a) An island (b) Aquarium
(c) Desert (d) Forest

5 The two components of an ecosystem are
(a) plants and animals
(b) weeds, trees, animals and man
(c) energy flow and mineral cycling
(d) biotic and abiotic

6 Abiotic components refer to
(a) non-living physico-chemical factors
(b) living physico-chemical factors
(c) gases produced by industries
(d) living organisms

7 Biotic components refer to
(a) gases produced by industries
(b) nutrient-deficient soil
(c) living organisms
(d) fossil fuels

8 Vertical distribution of different species occupying different levels in a biotic community is known as ***CBSE-AIPMT 2015***
(a) divergence (b) stratification
(c) zonation (d) pyramid

9 Stratification is more pronounced in
(a) tropical rainforest
(b) deciduous forest
(c) temperate forest
(d) tropical savannah

10 Which one of the following is not a functional unit of an ecosystem? ***CBSE-AIPMT 2012***

(a) Energy flow (b) Decomposition
(c) Productivity (d) Stratification

11 Maximum primary productivity of pond is achieved by

(a) phytoplankton (b) zooplankton
(c) floating plants (d) red algae

12 In a pond ecosystem, the autotrophic components are

(a) phytoplanktons
(b) algae
(c) submerged and marginal plants
(d) All of the above

13 Primary production is

(a) expressed in terms of weight (gm^{-2}) or energy (kcal m^{-2})
(b) the amount of biomass or organic matter produced per unit area over a time period by plants during photosynthesis
(c) Both (a) and (b)
(d) None of the above

14 The rate of biomass production is

(a) productivity
(b) photosynthesis
(c) respiration
(d) decomposition

15 In an ecosystem, the rate of production of organic matter during photosynthesis is termed as

(a) net primary productivity ***CBSE-AIPMT 2015***
(b) gross primary productivity
(c) secondary productivity
(d) net productivity

16 Net primary productivity is equal to

(a) organic matter synthesised by photosynthesis plus utilisation in respiration and other losses
(b) organic matter synthesised by photosynthesis minus utilisation in respiration and other losses
(c) rate of increase in body weight of producers plus loss suffered through respiration and damages
(d) rate of resynthesis of organic matter by the consumers

17 Secondary productivity is rate of formation of new organic matter by ***NEET 2013***

(a) producer
(b) parasite
(c) consumer
(d) decomposer

18 Primary productivity depends upon

(a) availability of nutrients
(b) photosynthetic capacity of plants
(c) Both (a) and (b)
(d) None of the above

19 Fill up the blanks.

I. Productivity varies in different ecosystems. It is the highest in …*A*… and lowest in …*B*….
II. Productivity varies in different seasons. Algal population is low in …*C*… and high in ….*D*….
III. …*E*… is required for higher primary productivity. …*F*… have the lowest primary productivity as the soil is deficient in moisture.

Choose the correct option for *A*, *B*, *C*, *D*, *E* and *F*.

(a) A–agriculture field, B–forest, C–winter, D–spring, E–Heat, F–Forest
(b) A–forest, B–pond, C–spring, D–summer, E–Rain, F–Forest
(c) A–coral reef, B–desert, C–winter, D–summer, E–Rain, F–Desert
(d) A–desert, B–coral reef, C–summer, D–winter, E–Forest, F–Desert

20 The process of breaking down complex organic matter into inorganic substances like CO_2, water and nutrient is called

(a) humification (b) mineralisation
(c) decomposition (d) leaching

21 Word detritus includes

(a) dead plant parts (b) remains of animals
(c) animal excretions (d) All of these

22 A detritivore is

(a) animal feeding on plant matter
(b) animal feeding on dead and decaying organic matter
(c) a plant feeding on an animal
(d) animal feeding on another animal

23 Which of the following is/are example(s) of detritivore?

(a) Millipedes (b) Earthworm
(c) Fiddler crabs (d) All of these

24 Earthworms are called farmer's friends because

(a) they help in fragmentation of detritus and loosening of soil
(b) they help in immobilisation of nutrients inside the soil
(c) they reduce the rate of decomposition
(d) Both (b) and (c)

25 The organisms which physically and chemically break the complex dead organic remains are known as

(a) scavangers (b) decomposers
(c) Both (a) and (b) (d) parasites

26 In which layer of soil decomposition occurs at maximum rate?

(a) Upper layer of soil (b) Middle layer of soil
(c) Lower layer of soil (d) None of these

27 The products of decomposition process are

(a) humus (b) inorganic nutrients
(c) organic nutrients (d) Both (a) and (b)

28 Breakdown of detritus into smaller particles by detritivores is a process called
(a) humification (b) fragmentation
(c) mineralisation (d) catabolism

29 The process by which water soluble inorganic nutrients go down into the soil horizon and get precipitated as unavailable salts is called as
(a) fragmentation
(b) leaching
(c) catabolism
(d) mineralisation

30 The enzymatic process by which degraded detritus is converted into simpler inorganic substances is called
(a) catabolism (b) leaching
(c) mineralisation (d) fragmentation

31 The process of accumulation of a dark coloured amorphous substance that is highly resistant to microbial action and undergoes decomposition at an extremely slow rate is called
(a) mineralisation (b) humification
(c) organisation (d) transformation

32 Humus is
(a) dark coloured amorphous organic matter rich in lignin
(b) dark coloured organic matter rich in cellulose
(c) Both (a) and (b)
(d) red coloured substance rich in iron

33 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 the formation of humus

34 The climatic factors that regulate soil microbe activities during decomposition are
(a) temperature (b) soil moisture
(c) Both (a) and (b) (d) wind

35 The rate of decomposition is dependent on ..... .
(a) chemical nature of detritus
(b) temperature and pH
(c) moisture and aeration
(d) All of the above

36 The organic substances, which decompose slowly are
(a) chitin (b) lignin
(c) cellulose (d) All of these

37 The rate of decomposition is quicker when detritus is rich in
(a) nitrogen and sugar (b) phosphorus and sugar
(c) calcium and sugar (d) Both (b) and (c)

38 Which one of the following processes can slow down the process of decomposition?
(a) anaerobiosis (b) aerobiosis
(c) photo-oxidation (d) photophosphorylation

39 Which one of the following processes during decomposition is correctly matched? ***NEET 2013***

(a) Fragmentation	Carried out by organisms such as earthworm
(b) Humification	Leads to the accumulation of a dark coloured substance humus, which is resistant to microbial action and undergoes decomposition at a very fast rate
(c) Catabolism	Last step in the decomposition under fully anaerobic condition
(d) Leaching	Water soluble inorganic nutrients rise to the top layers of soil

TOPIC 2 ~ *Energy Flow and Food Chain*

40 PAR stands for
(a) Photosynthesis Active Reaction
(b) Photosynthesis Absorb Radiation
(c) Photosynthetically Active Radiation
(d) Photosynthetically Active Reaction

41 Energy enters in any ecosystem through
(a) herbivores (b) carnivores
(c) producers (d) decomposers

42 Energy flow in an ecosystem is
(a) unidirectional (b) bidirectional
(c) multidirectional (d) All of these

43 The green plants in an ecosystem which can trap solar energy to convert it into chemical bond energy are called
(a) producer
(b) decomposer
(c) consumer
(d) predators

44 Ecosystems need a constant supply of energy
(a) to counteract increasing disorderliness
(b) to counteract decreasing disorderliness
(c) to synthesise molecules
(d) Both (a) and (c)

45 In a balanced ecosystem you would expect the biomass of the ..... to be greater than the biomass of any other groups of organisms. The most appropriate word to fill the blank is
(a) producer (b) primary consumers
(c) secondary consumers (d) top predators

46 All the animals that depend on plants (directly or indirectly) for food are called
(a) decomposers (b) root feeders
(c) consumers (d) grazers

47 Fill up the blanks.
I. Herbivores are also called …*A*…
II. Secondary consumers are eaten by larger …*B*….
III. …*C*… consumer eat the secondary consumers.
IV. A network of many food chains is called a …*D*….
Choose the correct option for *A, B, C* and *D*.
(a) A–secondary consumers, B–top predator, C–Quaternary, D–food web
(b) A–primary consumer, B–predators, C–Tertiary consumer, D–food web
(c) A–tertiary consumers, B–natural enemies, C–Primary consumer, D–food web
(d) A–quaternary consumers, B–alligator, C–Top consumer, D–food web

48 Frog that feeds on insects, is a
(a) primary consumer (b) secondary consumer
(c) tertiary consumer (d) decomposer

49 Which one of the following pairs belongs to the category of primary consumers?
(a) Insects and cattles (b) Eagle and snakes
(c) Insects and snakes (d) Snakes and frogs

50 Identify the food chain.
Dead animal → Blow fly maggots → Common frog → Snake
(a) Grazing food chain
(b) Detritus food chain
(c) Decomposer food chain
(d) Predator food chain

51 A lion that eats a zebra that ate grass is a
(a) primary producer (b) primary consumer
(c) secondary consumer (d) quaternary consumer

52 A bear that eats a fish that further ate bugs that ate algae is a
(a) primary producer (b) primary consumer
(c) secondary consumer (d) tertiary consumer

53 A person who eats a chicken that ate grain is a
(a) primary producer
(b) primary consumer
(c) secondary consumer
(d) quaternary consumer

54 Vegetable eating person acts as
(a) primary producer (b) primary consumer
(c) secondary consumer (d) tertiary consumer

55 What is common characteristic of earthworm, soil mites and dung beetle of an ecosystem?
(a) Primary producer (b) Primary consumer
(c) Secondary consumer (d) Tertiary consumer

56 Fill up the blanks.
I. Animals which feed directly on plants, are called …*A*….
II. Consumers that feed on primary consumers are called …*B*….
III. In an ecosystem two laws of thermodynamics govern the …*C*….
Choose the correct option for *A, B* and *C*.
(a) A–herbivores, B–carnivores, C–flow of energy
(b) A–autotrophs, B–heterotrophs, C–trophic level
(c) A–photosynthesisers, B–higher levels predators, C–flow of energy
(d) A–predators, B–grazers, C–trophic level

57 Which of the following two organisms are producers?
(a) Plants and phytoplanktons
(b) Plants and consumers
(c) Zooplanktons and phytoplanktons
(d) Phytoplanktons and chlorophylls

58 A sequence of species or organism through which the food energy pass in a community is called
(a) pyramid of energy (b) food chain
(c) food web (d) nutrient cycle

59 Food chain refers to
(a) number of humans forming a chain for food
(b) animals gathered near a source of food
(c) transfer of energy from producers to consumers
(d) None of the above

60 Food chain starts with
(a) N_2-fixation (b) osmosis
(c) respiration (d) photosynthesis

61 Food chain consists of
(a) plants (b) herbivores
(c) carnivores (d) All of these

62 In grazing food chain, energy comes from
(a) organic remain (b) sun
(c) water (d) All of these

63 …… starts with green plants called producers as the first trophic level. The most appropriate choice for filling blank space is
(a) detritus food chain
(b) grazing food chain
(c) complex food chain
(d) normal food chain

64 A much larger fraction of energy flows in a terrestrial ecosystem through
(a) grazing food chain
(b) detritus food chain
(c) complex food chain
(d) food web aquatic ecosystem

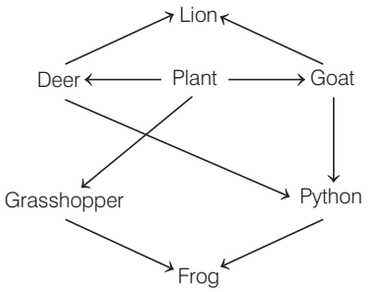
65 Which food chain correctly describes the flow of energy in an ecosystem?
(a) Grass → cow → human
(b) Caterpillar → leaf → human
(c) Cow → grass → human
(d) Leaf → bird → caterpillar

66 A much large fraction of energy flows in an aquatic ecosystem through
(a) grazing food chain (b) detritus food chain
(c) complex food chain (d) food web

67 In what order do a hawk, grass and rabbit form a food chain in a meadow?
(a) Hawk → grass → rabbit
(b) Grass → hawk → rabbit
(c) Rabbit → grass → hawk
(d) Grass → rabbit → hawk

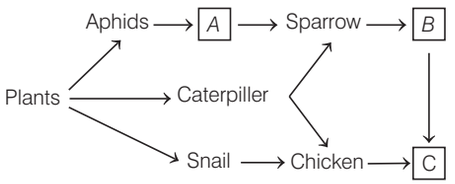
68 A food web
(a) is more real than food chain
(b) consists of a number of food chains interlinked at various trophic levels
(c) provides a number of alternate food to consumers
(d) All of the above

69 How many food chains are there in the food web shown below?



(a) 2 (b) 3 (c) 5 (d) 7

70 Identify *A, B* and *C* from the given flowchart.



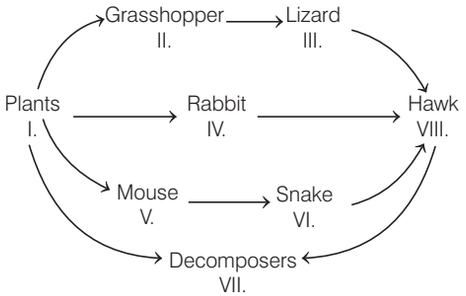
(a) A–Bulbul, B–Snake, C–Monkey
(b) A–Beetle, B–Lizard, C–Praying mantis
(c) A–Ladybird, B–Snake, C–Hawk
(d) A–Lizard, B–Bird, C–Snake

71 Select the options that correctly identifies *A*, *B* and *C* in the given table.

Organisms	Trophic level	Type of food chains
Eagle	*A*	Grazing
Earthworm	Primary consumer	*B*
C	Secondary consumer	Grazing

(a) A–Secondary consumer, B–Grazing, C–Algae
(b) A–Top carnivore, B–Detritus, C–Frog
(c) A–Scavenger, B–Grazing, C–Hawk
(d) A–Decomposer, B–Detritus, C–Perch

72 Which of the following organisms in the given food web act as a secondary consumers?



(a) I and IV (b) V and VI
(c) III and VI (d) IV and VII

73 Which of the following organisms in the given food web (fig of Q. 72) acts as a primary consumers?
(a) II, IV and V (b) I, II and III
(c) II, III and IV (d) IV, VII and VIII

74 Energy for the detritus food chain comes from
(a) organic remain (b) air
(c) radiation (d) water

75 …… begins with dead organic matter and saprophytes make the first trophic level. Most appropriate word for filling blank space is
(a) Detritus food chain (b) Grazing food chain
(c) Complex food chain (d) Normal food chain

76 Choose the incorrect option.
(a) GFC (Grazing Food Chain) begins with producers at the first trophic level
(b) GFC binds up inorganic nutrients, while detritus chain helps in releasing inorganic nutrients to the cycling pool
(c) Both (a) and (b)
(d) Detritus chain account for less energy flow than grazing food chain

77 In an ecosystem, organism occupies a specific place in a food chain is called
(a) Branching lines (b) Progressive straight line
(c) Trophic level (d) Standing crop

78 Given flowchart represents grazing and detritus food chain.

Grazing food chain: Grass →Rabbit→ Lion

Detritus food chain: Dead leaves→ Wood louse → Black bird

The organisms which constitute the first trophic level of the grazing food chain and the detritus food chain are respectively,

(a) grass and dead leaves
(b) grass and wood louse
(c) rabbit and wood louse
(d) rabbit and black bird

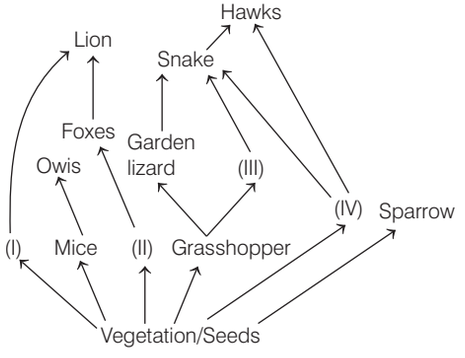
79 The organisms, which attack dead animals are

(a) first link of the food chain and are known as primary producers
(b) second link the food chain and are herbivorous
(c) third link of the food chain and are tertiary consumers
(d) present at the starting of food chain and are detritivores

80 Select the incorrect food chain.

(a) Grass → Frog → Vulture
(b) Grass → Grasshopper → Frog → Snake → Eagle
(c) Grass → Deer → Lion
(d) Phytoplankton → Zooplankton → Fish (perch) → Fish (bass) → Man

81 Identify the likely organisms (I), (II) (III) and (IV) in the food web shown below. ***CBSE-AIPMT 2012***



	I	II	III	IV
(a)	Deer	Rabbit	Frog	Rat
(b)	Dog	Squirrel	Bat	Deer
(c)	Rat	Dog	Tortoise	Crow
(d)	Squirrel	Cat	Rat	Pigeon

82 Identify the possible link '*A*' in the following food chain.

Plant → Insect → Frog → '*A*' → Eagle

CBSE-AIPMT 2012

(a) Rabbit (b) Wolf
(c) Cobra (d) Parrot

83 The mass of living material at a trophic level at a particular time is called ***CBSE-AIPMT 2015***

(a) gross primary productivity
(b) standing state
(c) net primary productivity
(d) standing crop

84 The 10% law is related to

(a) Mendelian genetics
(b) non-Mendelian genetics
(c) energy transfer from lower trophic level to higher trophic level
(d) energy consumption during photosynthesis in C_4-plants

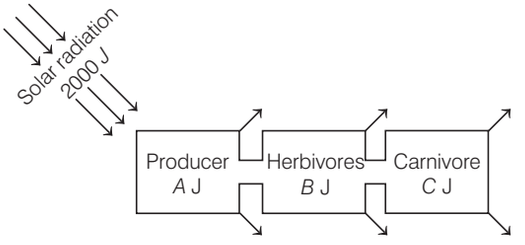
85 The 10% law for energy transfer in food chains was given by

(a) Stanley (b) Tansley
(c) Lindemann (d) Weismann

86 What percentage of herbivore's chemical energy is transferred to the chemical energy within the carnivore tissue?

(a) 100% (b) 50%
(c) 1% (d) 10%

87 Suppose 2000 J of solar energy is incident on green vegetation. On the basis of 10% law of Lindemann. Identify *A, B* and *C*.



(a) A – 20 J, B – 2 J, C – 0.2 J
(b) A – 200 J, B – 20 J, C – 2 J
(c) A – 400 J, B – 40 J, C – 4 J
(d) A – 40 J, B – 4 J, C – 0.4 J

88 The tiger is left with 10J of energy in a grass–deer–tiger food chain. The energy available at grass level is

(a) 100 J (b) 2000 J
(c) 1000 J (d) 10,000 J

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

Plant → Mice → Snake → Peacock

CBSE-AIPMT 2014

(a) 0.02 J (b) 0.002 J
(c) 0.2 J (d) 0.0002 J

TOPIC 3 ~ *Ecological Pyramids*

90 The relation between producers and consumers in an ecosystem can be graphically represented in the form of a pyramid called
(a) ecological pyramid
(b) trophic level
(c) Pi chart
(d) pyramid of biomass

91 In ecological pyramid, the base always represents the …*A*… and the apex represents …*B*… . Here, *A* and *B* represent.
(a) A–producers, B–top level consumers
(b) A–top level consumers, B–producers
(c) A–producers, B–secondary consumers
(d) A–producers, B–primary consumers

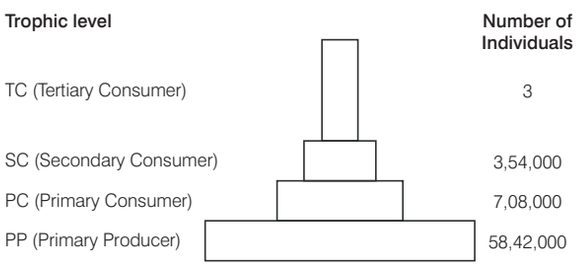
92 To show how many organisms are present at each level of a food chain, ecologists use a model called
(a) an energy flow pyramid
(b) pyramid of numbers
(c) pyramid of energy
(d) food chain/food web pyramid

93 How many trophic levels human beings function at in a food chain?
(a) 1 (b) 2
(c) 3 (d) 4

94 The upright pyramid of number is absent in
CBSE-AIPMT 2012
(a) pond (b) forest
(c) lake (d) grassland

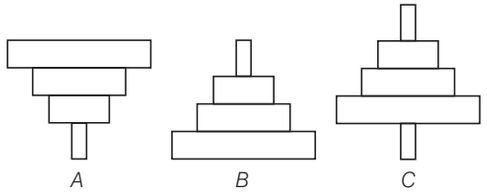
95 Which of the following ecological pyramid are always inverted?
(a) Pyramid of number in parasitic food chain and pyramid of biomass in pond ecosystem
(b) Pyramid of number in pond ecosystem and pyramid of biomass in pond ecosystem
(c) Pyramid of number in pacific food chain and pyramid of number in pond ecosystem
(d) All of the above

96 Given below is one of the types of ecological pyramids.



This type represents
(a) pyramid of number in a grassland ecosystem
(b) pyramid of energy in forest ecosystem
(c) pyramid of biomass in sea ecosystem
(d) pyramid of biomass in terrestrial ecosystem

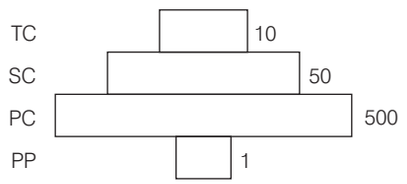
97 Which of the following representations show both the pyramid of numbers and biomass in a grassland ecosystem?



(a) A (b) B (c) C (d) None of these

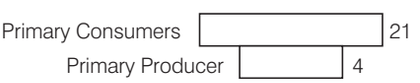
98 Peacock eats a snake and snake eats frog and frog eats insects, while insects eat green plants. The position of peacock is
(a) primary producer
(b) secondary producer
(c) decomposer
(d) at the apex of food ecological pyramid

99 Given below is an imaginary pyramid of number. What could be one of the possibilities about certain organisms at some of the different levels?
CBSE-AIPMT 2012



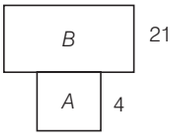
(a) Level PC is insects and level SC is small insectivorous birds
(b) Level PP is phytoplanktons in sea and whale on top level TC
(c) Level one PP is peepal trees and the level SC is sheep
(d) Level PC is rats and level SC is cats

100 Which kind of pyramid is represented by the given diagram?



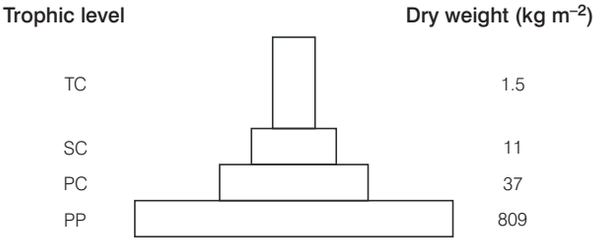
(a) Pyramid of number in tree ecosystem
(b) Pyramid of biomass in tree ecosystem
(c) Pyramid of biomass in aquatic ecosystem
(d) Pyramid of energy in tree ecosystem

101 Given diagram represents a pyramid of biomass in an aquatic system.



Identifies *A* of *B* and select correct options.
(a) A is phytoplanktons and B is zooplanktons
(b) A is zooplanktons and B is phytoplanktons
(c) A is small body animals
(d) B is small body animals

102 Given below is one of the type of ecological pyramids.



This type represents
(a) pyramid of energy in a grassland
(b) pyramid of biomass
(c) pyramid of number in a lake
(d) pyramid of energy in a fallow land

103 An inverted pyramid of …*A*… may occasionally be observed in …*B*… communities.
(a) A–energy, B–grassland
(b) A–energy, B–forest
(c) A–biomass, B–marine
(d) A–biomass, B–grassland

104 Which of the following always has a pyramidal shape, that is, decreasing values at higher trophic levels?
(a) Pyramid of number
(b) Pyramid of biomass
(c) Both (a) and (b)
(d) Pyramid of energy

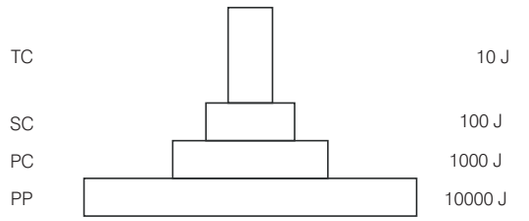
105 Which is an example of true pyramid in an ecosystem?
(a) Pyramid of biomass
(b) Pyramid of number
(c) Pyramid of energy
(d) None of the above

106 Pyramid of …… is never inverted.
(a) energy (b) mass
(c) numbers (d) size

107 Pyramid of biomass is more real than the pyramid of number
(a) the pyramid of number does not take into consideration the size of the individual
(b) maximum biomass occurs in top carnivores
(c) it can be inverted in terrestrial ecosystem and upright in aquatic ecosytsem
(d) Both (a) and (b)

108 The pyramid of energy is always upright for any ecosystems. This situation indicates the fact that
(a) producers have the lowest energy conversion efficiency
(b) carnivores have a better energy conversion efficiency than herbivores
(c) energy conversion efficiency is the same in all trophic levels
(d) herbivores have a better energy conversion efficiency than carnivores

109 Given below is the diagram of the ecological pyramids.



This type represents
(a) pyramid of number in a grassland
(b) pyramid of biomass in a lake
(c) pyramid of biomass in a land
(d) pyramid of energy

110 Which of the following ecological pyramids is generally inverted? ***NEET 2019***
(a) Pyramid of energy
(b) Pyramid of biomass in a forest
(c) Pyramid of biomass in a sea
(d) Pyramid of numbers in grassland

111 Which ecosystem has the maximum biomass? ***NEET 2017***
(a) Forest ecosystem (b) Grassland ecosystem
(c) Pond ecosystem (d) Lake ecosystem

112 What type of ecological pyramid would be obtained with the following data? ***NEET 2018***

Secondary consumer : 120 g
Primary consumer : 60 g
Primary producer : 10 g
(a) Upright pyramid of numbers
(b) Pyramid of energy
(c) Inverted pyramid of biomass
(d) Upright pyramid of biomass

TOPIC 4 ~ *Ecological Succession*

113 During ecological succession, ***CBSE-AIPMT 2015***
(a) the gradual and predictable change in species composition occurs in a given area
(b) the establishment of a new biotic community is very fast in its primary phase
(c) the numbers and types of animals remain constant
(d) the changes lead to a community that is in near equilibrium with the environment and is called pioneer community

114 Ecological succession is a sequence of series leading from baren land to the …… .
(a) seral community (b) climax community
(c) pioneer species (d) benthos

115 Climax community is
(a) stable (b) self-perpetuating
(c) final biotic community (d) All of these

116 In ecological succession, the communities in near equilibrium with the environment, are called
(a) climax communities
(b) eco-friendly communities
(c) seral communities
(d) pioneer communities

117 In plant succession, when climax community is reached, the net productivity
(a) continues to increase (b) becomes zero
(c) becomes reduced (d) becomes stable

118 The nature of climax community in ecological succession is most dependent upon
(a) climate (b) water
(c) soil fertility (d) None of these

119 The entire sequence of communities that successively changes in a given area are called
(a) sere (b) climax
(c) pioneer (d) xerarch

120 An individual transitional communities in ecological succession are termed as
(a) climax community (d) pioneer community
(c) seral community (d) single community

121 In the successive seral stages, there is
(a) change in the diversity of species, of organisms
(b) Increase in the number of species and organisms
(c) increase in total biomass
(d) All of the above

122 The species that invade a bare area in ecological succession are called
(a) benthos (b) biological species
(c) seral species (d) pioneer species

123 Primary succession is the development of communities on
(a) cleared forest area
(b) previously unoccupied sites
(c) fresh harvested crop field
(d) pond filled after a day season

124 During …… succession the establishment of new biotic community is generally low. The most appropriate word to fill the blank is
(a) primary (b) secondary
(c) tertiary (d) quaternary

125 Primary succession which occurs on a primary barren area
(a) is quite hostile to first life of pioneer community
(b) takes a very long time
(c) where pioneer community comes from outside
(d) All of the above

126 Primary succession on rocks starts with
(a) lichen (b) grass
(c) mosses (d) ferns

127 In lithosere, foliose lichens make the conditions favourable for the growth of
(a) crustose lichens (b) mosses
(c) annual grasses (d) perennial grasses

128 …… succession begins in area where natural biotic communities have been destroyed. The most appropriate word to fill the blank is
(a) Primary (b) Secondary
(c) Tertiary (d) Quaternary

129 The second stage of hydrosere is occupied by plants like ***CBSE-AIPMT 2012***
(a) *Azolla* (b) *Typha*
(c) *Salix* (d) *Vallisneria*

130 Secondary succession takes place on/in ***CBSE-AIPMT 2015***
(a) bare rock (b) degraded forest
(c) newly created pond (d) newly cooled lava

131 Find out the correct order of succession levels in xerarch.
(a) Lichen → Moss stage → Annual herb stage → Perennial herb stage → Shrub stage → Forest
(b) Annual herb stage → Perennial herb stage → Lichen → Moss stage → Shrub stage → Forest
(c) Shrub stage → Forest → Annual herb stage → Perennial herb stage → Lichen → Moss stage
(d) Forest → Shrub stage → Annual herb stage → Perennial herb stage → Lichen → Moss stage

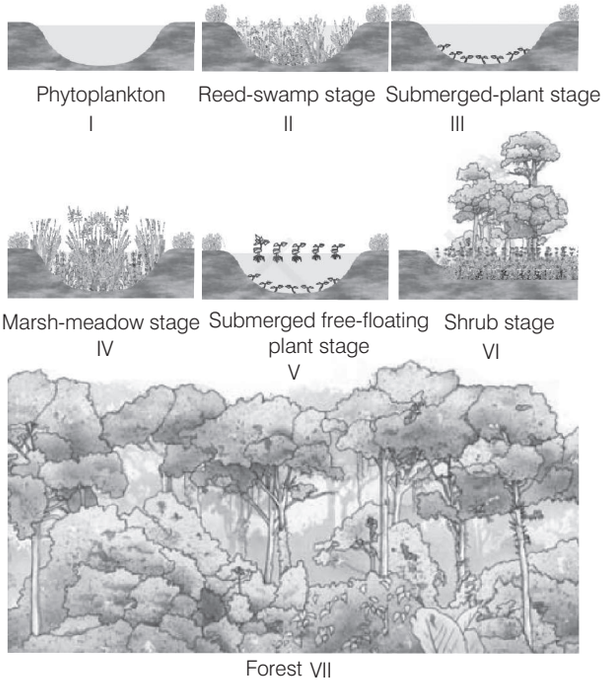
132 Primary succession in water, the pioneer species are
(a) free-floating angiosperm
(b) small phytoplanktons
(c) rooted hydrophytes
(d) lichens

133 Which one of the following is correct for xerarch succession?
(a) Successional series from xeric to mesic condition
(b) Successional series from hydric to mesic condition
(c) Both (a) and (b)
(d) None of the above

134 In secondary succession, the species that invade depend on
(a) the condition of soil
(b) availability of water
(c) seeds or other propagules
(d) All of the above

135 Fill in the missing stages (*A* to *D*) in the given primary hydrarch succession.
Phytoplankton → (*A*) → (*B*) → (*C*) → Marsh-meadow stage → (*D*) → Forest plant stage.
(a) A–Reed-swamp stage, B–Submerged plant stage, C–Submerged free-floating plant stage, D–Shrub stage
(b) A–Submerged plant stage, B–Submerged free-floating plant stage, C–Reed-swamp stage, D–Shrub stage
(c) A–Shrub stage, B–Submerged plant stage, C–Reed-swamp stage, D–Submerged free-floating plant stage
(d) A–Reed-swamp stage, B–Shrub stage, C–Submerged plant stage, D–Submerged free-floating plant stage

136 Following are the different stages in primary succession in water.



Which of the following is the logical sequence of primary succession in water?
(a) II → IV → V → VII → I → III → VI
(b) I → III → V → II → IV → VI → VII
(c) V → II → IV → VI → VII → III → I
(d) VI → VII → III → I → V → II → IV

TOPIC 5 ~ *Nutrient Cycling and Ecosystem Services*

137 The total amount of nutrients like carbon, phosphorus, calcium, etc., present in soil at any time is called
(a) standing crop (b) standing state
(c) nutrient crops (d) sediment

138 In an ecosystem, the cycling of nutrient is known as
(a) geological cycle (b) chemical cycle
(c) geochemical cycle (d) biogeochemical cycle

139 The reservoir for the gaseous type of biogeochemical cycle exists in
(a) stratosphere (b) atmosphere
(c) ionosphere (d) lithosphere

140 Which of the following pair is a gaseous type of biogeochemical cycle?
(a) Nitrogen and carbon cycle
(b) Phosphorus and carbon cycle
(c) Nitrogen and sulphur cycle
(d) Sulphur and carbon cycle

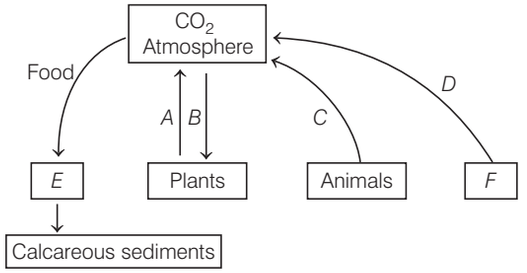
141 In a …… cycle, the elements returns and is withdrawn from the atmosphere. Most appropriate word to fill the blank is
(a) gaseous (b) sedimentary
(c) Both (a) and (b) (d) None of these

142 The reservoir for the sedimentary cycle exists in
(a) earth's crust (b) organic sediments
(c) calcareous sediments (d) limestone

143 In sedimentary nutrient cycling,
(a) the reservoir pool is lithosphere
(b) the sedimentary cycles are less perfect
(c) the withdrawl from reservoir pool is large
(d) All of the above

144 Which one of the following is not a gaseous biogeochemical cycle in ecosystem?
CBSE-AIPMT 2012
(a) Oxygen cycle (b) Phosphorus cycle
(c) Nitrogen cycle (d) Carbon cycle

145 Complete the following model of carbon cycle filling *A, B, C, D, E* and *F*.



(a) A–Osmosis, B–Photosynthesis, C–Respiration, D–Burning of fuel wood, E–Forest food chain, F–Limestone
(b) A–Photorespiration, B–Respiration, C–Respiration, D–Burning of organic debris, E–Pond food chain, F–Dolomite
(c) A–Respiration, B–Photosynthesis, C–Respiration, D–Combustion of fossil fuels, E–Aquatic food chain, F–Coal, oil
(d) A–Respiration, B–Photosynthesis, C–Respiration, D–Burning of forest, E–Terrestrial food chain, F–Forest

146 What is the reason behind deficit rising in nutrient reservoir?
(a) Due to imbalance in the rate of influx
(b) Due to imbalance in the rate of efflux
(c) Due to imbalance in the rate of influx and efflux
(d) None of the above

147 Carbon constitutes …… of dry weight of an organism. Most appropriate word to fill the blank is
(a) 49% (b) 59%
(c) 69% (d) 39%

148 …… of the carbon is found dissolved in oceans, which is responsible for its regulation in atmosphere. Most appropriate word to fill the blank is
(a) 51% (b) 81%
(c) 61% (d) 71%

149 Which of the following regulates the amount of carbon dioxide in the atmosphere
(a) respiration in animals
(b) respiration in plants
(c) photosynthesis activity of plants
(d) oceanic resesvoir of carbon

150 What is the medium by which carbon cycle takes place?
(a) Through atmosphere
(b) Through ocean
(c) Through living and dead organisms
(d) All of the above

151 What human activities are responsible to increase the amount of CO_2 in the atmosphere?
(a) Deforestation
(b) Massive burning of fossil fuels
(c) Vehicle used for transport
(d) All of the above

152 Which of the following factor is contributing to an overload of the carbon cycle?
(a) Photosynthesis (b) Cellular respiration
(c) Deforestation (d) Afforestation

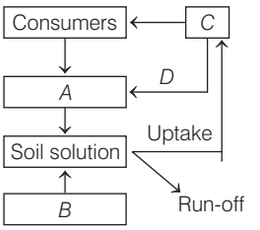
153 The exchange pool in the carbon cycle is
(a) fossil fuels (b) sedimentary rock
(c) water (d) atmosphere

154 Which element is formed by the weathering of rocks and absorbed by plant from the soil?
(a) Phosphorus (b) Carbon (c) Nitrogen (d) Oxygen

155 Phosphorus is needed for the production of
(a) DNA and RNA (b) cellular membranes
(c) bones and teeth (d) All of these

156 In the phosphorus cycle, weathering makes phosphate available first to
(a) producers (b) decomposers
(c) consumers (d) None of these

157 Given below is a simplified model of phosphorus cycling in a terrestrial ecosystem with four blanks (*A-D*). Identify the blanks. ***CBSE-AIPMT 2014***



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

158 Select the incorrect match. ***AIIMS 2018***
I. Sedimentary nutrient cycle–Nitrogen cycle
II. Pioneer species–Lichens
III. Secondary succession–Burned forests
IV. Pyramid of biomass of aquatic ecosystem–Upright
Codes
(a) I and IV (b) I, II and III (c) I and III (d) III and IV

159 Fill up the blank.
I. The products of ecosystem processes are called…*A*… .
II. …*B*… are the major source of ecosystem services.
III. …*C*… and his colleagues tried to put price tags on nature's life support services, which came up to US …*D*… a year.
Choose the correct option for *A*, *B*, *C* and *D*.
(a) A–Ecosystem services, B–Plants, C–Robert Brown, D–31 trillion
(b) A–Ecology services, B–Plants, C–Robert Constanza, D–32 trillion
(c) A–Ecosystem services, B–Forests, C–Robert Constanza, D–33 trillion
(d) A–Ecology services, B–Ponds, C–Robert Brown, D–34 trillion

NEET

SPECIAL TYPES QUESTIONS

I. Assertion and Reason

■ **Direction** (Q. Nos. 160-168) *In each of the following questions, a statement of Assertion (A) is given by corresponding statement of Reason (R). Of the statements, mark the correct answer as*

(a) If both A and R are true and R is the correct explanation of A

(b) If both A and R are true, but R is not the correct explanation of A

(c) If A is true, but R is false

(d) If A is false, but R is true

160 **Assertion** (A) An ecosystem is an interaction between biotic and abiotic components.
Reason (R) AG Tansley coined the term ecosystem.

161 **Assertion** (A) Bacteria and fungi are microconsumers.
Reason (R) Bacteria and fungi use a very little part of living plant and animals.

162 **Assertion** (A) Herbivores are also called as first order consumers.
Reason (R) These obtain their food directly from plants.

163 **Assertion** (A) A network of food chains existing together in an ecosystem is known as a food web.
Reason (R) An animal like kite cannot be a part of a food web.

164 **Assertion** (A) The pyramid of energy is always upright.
Reason (R) The flow of energy is unidirectional.

165 **Assertion** (A) The pyramid of number of pond ecosystem is upright.
Reason (R) Phytoplanktons are maximum and secondary consumers are lesser in number.

166 **Assertion** (A) Ecological succession can turn a lake into a dryland forest with time.
Reason (R) A bare rock can become a forest through ecological succession.

167 **Assertion** (A) Nutrient cycle means the cycling of glucose or reserved food material within the plant body.
Reason (R) Transfer of biogenetic nutrients between living and non-living components is called biogeochemical cycle.

168 **Assertion** (A) Oceans act as the global sink for CO_2.
Reason (R) Human activities are increasing CO_2 concentration in the air.

II. Statement Based Questions

169 Consider the following statements.

I. Forest, glassland and desert are examples of terrestrial ecosystem.

II. Pond, lake, wetland, river and estuary are examples of aquatic ecosystem.

(a) Statement I is true, but II is false
(b) Statement I is false, but II is true
(c) Both statements I and II are true
(d) Both statements I and II are false

170 Consider the following statements.

I. The components of ecosystem do not include decomposition.

II. Decomposers are saprophytic organisms like fungi, bacteria and flagellates especially abundant in the bottom of the pond.

Choose the correct option.

(a) I is true, but II is false (b) I is false, but II is true
(c) Both I and II are true (d) Both I and II are false

171 Consider the following statements.

I. Producers are also called as transducers because they are able to change radiant energy into chemical form.

II. Consumers are animals, which feed on other organisms or their parts.

III. Decomposers are saprotrophs, which feed on dead bodies of organisms.

Which of the statements given above are correct?

(a) I, II and III (b) I and II (c) I and III (d) II and III

172 Select the true statements.

I. Productivity can be divided into gross primary productivity and net primary productivity.

II. Net primary productivity is the available biomass for the consumption to heterotrophs.

III. Net primary productivity is equal to gross primary productivity minus respiration.

IV. There is unidirectional movement of energy towards higher trophic levels and its dissipation and loss as heat to the environment.

Choose the correct option.

(a) I, II and III (b) I and IV
(c) II and III (d) I, II, III and IV

173 Identify the incorrect statement.

(a) The annual net primary productivity of the whole biosphere is approximately 170 billion tonnes of organic matter

(b) The gaseous exchanges of phosphorus between organism and environment are negligible

(c) In the successive seral stages, there is a change in the diversity of species of organisms, decrease in the number of species and organisms as well as decrease in the total biomass

(d) In secondary succession, the species that invade depend on the condition of the soil, availability of water, the environment as also the seeds or other propagules present

174 Read the following statements.

I. Identification and enumeration of plant and animal species of an ecosystem given its species composition.

II. Despite occupying about 70% of the surface, the productivity of the oceans are only 55 billion tons.

III. A constant input of solar energy is the basic requirement for any ecosystem to function and sustain.

IV. Sugarcane have more efficiency to trap sunlight, so they accumulate more primary productivity.

Which of the statements given above are correct?

(a) I and II (b) I and IV

(c) I, II, III and IV (d) None of these

175 Choose the incorrect statement(s) for a pond ecosystem.

I. Abiotic component is water with all inorganic and organic substances dissolved in it.

II. There is no means to regulate the rate of function of the entire pond.

III. Consumers are zooplankton and decomposers are fungi, bacteria and flagellates.

IV. Heterotrophs consumer autotrophs.

V. Autotrophs traps radiant energy of the sun.

(a) I, II and III

(b) II, III and IV

(c) III, IV and V

(d) Only II

176 Choose the true/false statements from the given set.

I. Decomposition rate is higher when detritus is enriched with lignin and chitin.

II. The humus formed during humification is further degraded by some microbes and release inorganic nutrients *via* mineralisation process.

Choose the correct option.

(a) I is true, while II is false

(b) I and II both are true

(c) I is false, while II is true

(d) I and II both are false

177 Which of the following statements is/are not true?

I. Below ground detritus constitutes leaf litter, dried plant parts, remains of animals, their droppings and excretions.

II. Above ground detritus mainly constitutes dead roots, underground dead animals, etc.

III. Decomposition completely disposes off the whole detritus.

IV. Humus is rich in chitin and lignin.

(a) I, II and III (b) I, II and IV

(c) I and II (d) II and III

178 Study the following statements.

I. Decomposition is a carbon dioxide requiring process.

II. Humus is colloidal in nature and serves as a reservoir of nutrients.

III. Warm and moist environment slows down decomposition.

IV. Humification and mineralisation occur during decomposition in the soil.

Which of the statements given above are correct?

(a) II and IV (b) I and III

(c) I and II (d) III and IV

179 Read the statements given below.

I. A straight single pathway through which food travels in an ecosystem.

II. Members of high trophic level feed on lower trophic level animals.

III. No addition to the adaptibility and competitiveness of the organism.

IV. Links different organisms *via* their nutritional requirements.

The above statements correlate with

(a) food web

(b) detritus food chain

(c) ecological pyramid of energy

(d) food chain

180 Consider the following statements about food chain.

I. The transfer of energy from producers to top consumers through a series of organisms is called food chain.

II. A food chain is always straight and proceeds in a progressive straight line.

III. In a food chain, there is unidirectional flow of energy from sun to producers and after that to series of different types of consumers.

Which of the statements given above are correct?

(a) I and II (c) I and III

(b) II and III (d) I, II and III

181 Consider the following statements.

I. In a food chain, one organism holds only one position.
II. In a food chain the flow of energy can be easily calculated.
III. In food chain, competition is limited to the members of same trophic level.

Which of the statements given above are correct?

(a) I, II and III (b) I and II
(c) I and III (d) II and III

182 Consider the following statements.

I. In a terrestrial ecosystem, major producers are herbaceous and woody plants.
II. In an aquatic ecosystems, species like phytoplankton, algae and higher plants are producers.
III. Primary consumers are herbivores.
IV. Primary carnivores are secondary consumers.

Choose the option with correct statements.

(a) I and II
(b) III and IV
(c) I and III
(d) I, II, III and IV

183 Choose the correct option for the incorrect statements from the following.

I. Plants form second trophic level.
II. Herbivores eat grass and form first trophic level.
III The example of top carnivore is tertiary level consumers.
IV. Detritivores are also a form of consumers.

(a) I and II (b) II and III
(c) III and IV (d) I and IV

184 Grazing food chain.

I. It starts with green plant called producers as first trophic level.
II. A much less fraction of energy flows through this type of food chain in terrestrial ecosystem.
III. Energy for grazing food chain comes from organic remain or detritus.

Which of the statements given above are correct?

(a) I and II (b) I and III
(c) II and III (d) I, II and III

185 Regarding detritus food chain.

I. It begins with dead organic matter and decomposers called saprophytes as first trophic level.
II. A much large fraction of energy flows through this type of food chain in terrestrial ecosystem.
III. Energy for detritus food chain comes from sun.

Which of the statements given above are correct?

(a) I and II
(b) I and III
(c) II and III
(d) I, II and III

186 Read the following statements.

I. Decomposers are heterotrophs.
II. Detritus food chain and decomposers are related with each other.
III. The natural water connection of food levels forms food chain.
IV Decomposers are also called as consumers.

Which of the statements given above are correct?

(a) I and II are true, III and IV are false
(b) I and III are true, II and IV are false
(c) III and IV are true, I and II are false
(d) All statements are true

187 Consider the following statements about food web.

I. One organism hold more than one position.
II. The flow of energy is very difficult to calculate.
III. Instead of straight line it is a series of branching lines.
IV. Competition is amongst the members of same and different trophic levels.

Which of the statements given above are correct?

(a) I, II and III (b) I, III and IV
(c) II, III and IV (d) I, II, III and IV

188 Regarding 10% law.

I. This law was put forward by Lindemann in 1942.
II. According to this law, during the transfer of food energy from one tropical level to the other, only about 10% is stored at higher trophic level and the remaining 90% is lost in respiration, decomposition and waste in the form of heat.

Which of the statements given above is/are correct?

(a) Only I (b) Only II
(c) Both I and II (d) None of these

189 Which one of the following statements for pyramid of energy is incorrect?

(a) It is upright in shape
(b) Its base is broad
(c) It shows the energy content of organisms at different trophic level
(d) It is sometimes inverted in shape

190 Consider the following statements about pyramid of biomass.

I. When we plot the biomass (net dry weight) of producers, herbivores, carnivores and so on we have a pyramid of biomass.
II. Two types of pyramid of biomass are found, i.e. upright and inverted.
III. When larger weight of producers support a smaller of biomass weight of consumers an upright pyramid results.
IV. When smaller weight of producers support larger weight of consumers an inverted pyramid of biomass is formed.

Which of the statements given above are correct?

(a) I, II and III (b) I, III and IV
(c) II, III and IV (d) I, II, III and IV

191 Consider the following statements about ecological pyramids.

I. Charles Elton developed the concept of ecological pyramid.
II. After his name, these pyramids are also called as Eltonian pyramids.
III. It is a graphical representation or pyramid-shaped diagram which depicts the number of organisms, biomass and energy at each trophic level.

Which of the statements given above are correct?

(a) I and II (b) I and III
(c) II and III (d) I, II and III

192 Which of the following statements are correct about limitations of ecological pyramids?

I. It does not take into account same species belonging to two or more trophic levels.
II. It considers a simple straight food chain which almost never occurs in nature.
III. Saprophytes are not placed in ecological pyramids however they play vital role.
IV. It considers food web specific to an ecosystem.
V. Only three types of pyramids are prevalent, while there can be more existing in nature.

Choose the correct option.

(a) I, II and III (b) I, III and IV
(c) III, IV and V (d) I, II and III

193 I. Pioneer community is the final biotic community that develops in an area.
II. Growth is fast in pioneer community as compared to climax community.
III. Pioneer community develops partly from the previous occupants and parlty from migrants in primary succession.
IV. Pioneer community is soon replaced by the next seral community during ongoing succession.

Identify the incorrect statements.

(a) I and II
(b) I, II and III
(c) I and III
(d) III and IV

194 Choose the incorrect statement.

(a) Atmospheric inputs of phosphorus through rainfall are much smaller than carbon inputs
(b) Gaseous exchanges of phosphorus between organism and environment are negligible
(c) Phosphorus is released into the atmosphere by respiration
(d) Herbivores and animals obtain phosphorus from plants

195 Choose the incorrect statement about nutrient cycling.

I. The movement of nutrient elements through various components (abiotic and biotic) of an ecosystem is called biogeochemical cycle.
II. Environmental factors like soil, moisture, pH, temperature, etc., regulate the rate of release of nutrients into the atmosphere.
III. Atmosphere only contains about 10% of total global carbon.
IV. Fossil fuel also represents a reservoir of carbon.

(a) I and II (b) II and III
(c) III and IV (d) Only III

196 Read the following statements about carbon cycle.

I. About 4×10^{13} kg of carbon is fixed annually in the biosphere through photosynthesis.
II. Carbon return to the atmosphere as CO_2 through respiration by producers and consumers.
III. Decomposers return CO_2 to the atmosphere by processing of waste materials and dead organic matter of land or oceans.
IV. Burning of wood, combustion of organic matter, volcanic activities, etc., release CO_2 into the atmosphere.

Choose the correct option.

(a) Both statements I and II are true, but III and IV are false
(b) Both statements I and II are false, but III and IV are true
(c) All statements are true
(d) All statements are false

197 Consider the following statements about phosphorus cycle.

I. Major reservoirs or phosphorus are phosphate rocks and fossil bone deposits laid down in the past geological ages.
II. During weathering of rocks, minute amounts of these phosphates dissolve in soil solution and are absorbed by the roots of the plants.

(a) Statement I is true, but II is false
(b) Statement I is false, but II is true
(c) Both statements I and II are true
(d) Both statements I and II are false

198 Choose the correct statements about Ecosystem Services (ES). ***NEET 2018***

I. The value of the global gross national product GNP (Gross National Product) US and 18 trillion.
II. The soil formation accounts for about 50% of ES.
III. Recreation and nutrient cycling are less than 10% of ES.
IV. The cost of climate regulation and habitat for wildlife are about 6% each.

(a) I and II (b) III and IV
(c) I and III (d) I, II, III and IV

III. Matching Type Questions

199 Study the following columns and choose the correct option.

	Column I (Ecological terms)		Column II (Characteristics)
A.	Population	1.	Part of the earth consisting of all the ecosystems of the world.
B.	Community	2.	Assemblage of all the individuals belonging to different species occurring in an area.
C.	Ecosystem	3.	Group of similar individuals belonging to the same species found in an area.
D.	Biosphere	4.	Interaction between the living organisms and their physical environment components.

Codes

	A	B	C	D		A	B	C	D
(a)	3	2	1	4	(b)	5	2	3	4
(c)	2	3	5	1	(d)	3	2	4	1

200 Match the following columns.

	Column I (Components of ecosystem)		Column II (Feeding habits)
A.	Scavengers	1.	Autotrophs
B.	Parasites	2.	Heterotrophs
C.	Producers	3.	Consumers that feed on a small part of a living being
D.	Phagotrophs	4.	Consumers of dead bodies

Codes

	A	B	C	D		A	B	C	D
(a)	4	3	1	2	(b)	3	1	2	4
(c)	1	2	4	3	(d)	4	3	2	1

201 Match the following columns.

	Column I (Categories)		Column II (Examples)
A.	Inorganic substances	1.	Light, temperature and humidity.
B.	Organic compounds	2.	Soil, pH and minerals.
C.	Climatic factors	3.	Proteins, carbohydrates, lipids and nucleic acid.
D.	Edaphic factors	4.	Carbon, nitrogen, oxygen and water.

Codes

	A	B	C	D
(a)	3	1	2	4
(b)	4	3	1	2
(c)	1	2	3	4
(d)	4	2	1	3

202 Match the following columns.

	Column I		Column II
A.	Natural ecosystem	1.	Producer
B.	Decomposer	2.	Consumer
C.	Primary productivity	3.	Forest
D.	Secondary productivity	4.	Bacteria

Codes

	A	B	C	D		A	B	C	D
(a)	1	2	3	4	(b)	2	3	4	1
(c)	3	4	1	2	(d)	3	4	2	1

203 Match the following columns.

	Column I		Column II
A.	Carbon fixed annually through photosynthesis	1.	4×10^{13} kg
B.	Net primary productivity of biosphere	2.	170 billion tons
C.	Net primary productivity of oceans	3.	55 billion tons
D.	Sunlight	4.	40,00,000 J

Codes

	A	B	C	D		A	B	C	D
(a)	1	2	3	4	(b)	2	3	4	1
(c)	3	4	1	2	(d)	4	1	2	3

204 Match the following columns.

	Column I (Types of consumers)		Column II (Feeding habits)
A.	Primary consumers	1.	A meat eater that eats primary consumers
B.	Secondary consumers	2.	A meat eater that eats tertiary consumers
C.	Tertiary consumers	3.	A vegetable eater that eats producers
D.	Quaternary consumers	4.	A meat eater that eats secondary consumers.

Codes

	A	B	C	D		A	B	C	D
(a)	1	4	2	3	(b)	3	1	4	2
(c)	4	2	3	1	(d)	2	3	1	4

205 Match the following columns.

	Column I (Terms)		Column II (Features)
A.	Food chain	1.	An organism that eats meat.
B.	Food web	2.	An organism that eats plants.
C.	Heterotroph	3.	An organism that makes its food from light or chemical energy without eating.
D.	Autotroph	4.	An organism that gets its energy by eating other organisms.
E.	Carnivore	5.	The sequence of organisms, as who eats whom in a biological community.
F.	Herbivore	6.	The network of all the inter-related food chains in a biological community

Codes

	A	B	C	D	E	F
(a)	5	6	4	3	1	2
(b)	6	4	3	1	2	5
(c)	3	1	2	5	6	4
(d)	2	5	6	4	3	1

206 Match the following columns.

	Column I		Column II
A.	Primary succession	1.	Ecosystem development
B.	Climax community	2.	Crustose lichens
C.	Pioneer community on lithosphere	3.	Community that has completed succession
D.	Ecological succession	4.	Colonisation of a new environment

Codes

	A	B	C	D
(a)	3	2	1	4
(b)	4	3	2	1
(c)	1	2	3	4
(d)	4	3	1	2

207 Match the following columns.

	Column I (Seres)		Column II (Features)
A.	Xeroseres	1.	Ecological succession starts on terrestrial habitat
B.	Hydroseres	2.	Succession begins from open water bodies
C.	Lithoseres	3.	Succession begins on sand
D.	Psammoseres	4.	Succession starts on a bare rock

Codes

	A	B	C	D		A	B	C	D
(a)	3	1	2	4	(b)	4	3	1	2
(c)	1	2	4	3	(d)	2	4	3	1

208 Match the following columns. ***CBSE-AIPMT 2014***

	Column I		Column II
A.	Earthworm	1.	Pioneer species
B.	Succession	2.	Detritivore
C.	Ecosystem service	3.	Natality
D.	Population growth	4.	Pollination

Codes

	A	B	C	D		A	B	C	D
(a)	1	2	3	4	(b)	4	1	3	2
(c)	3	2	4	1	(d)	2	1	4	3

209 Match the following columns.

	Column I		Column II
A.	Standing state	1.	Carbon cycle
B.	Gaseous cycle	2.	Sulphur cycle
C.	Sedimentary cycles	3.	Species that invade a bare area
D.	Pioneer species	4.	Amount of nutrients

Codes

	A	B	C	D		A	B	C	D
(a)	1	2	3	4	(b)	4	1	2	3
(c)	4	1	3	2	(d)	3	4	1	2

NCERT & NCERT Exemplar

MULTIPLE CHOICE QUESTIONS

NCERT

210 Which one of the following has the largest population in a food chain?
(a) Producers (b) Primary consumers
(c) Secondary consumers (d) Decomposers

211 The second trophic level in a lake is
(a) phytoplankton (b) zooplankton
(c) benthos (d) fishes

212 Secondary producers are
(a) herbivores (b) producers
(c) carnivores (d) None of these

213 What is the percentage of Photosynthetically Active Radiation (PAR) in the incident solar radiation?
(a) 100% (b) 50% (c) 1-5% (d) 2-10%

NCERT Exemplar

214 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

215 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

216 Productivity is the rate of production of biomass expressed in terms of

I (Kcal m^{-3}) yr^{-1} II. $gm^{-2}yr^{-1}$

III $g^{-1}yr^{-1}$ IV. (kcal m^{-2}) yr^{-1}

(a) Only II (b) Only III

(c) II and IV (d) I and III

217 An inverted pyramid of biomass can be found in which ecosystem?

(a) Forest (b) Marine

(c) Grassland (d) Tundra

218 Which of the following is not a producer?

(a) *Spirogyra* (b) *Agaricus*

(c) *Volvox* (d) *Nostoc*

219 Which of the following ecosystems is most productive in terms of net primary production?

(a) Deserts (b) Tropical rainforests

(c) Oceans (d) Estuaries

220 Pyramid of numbers is

(a) always upright

(b) always inverted

(c) either upright or inverted

(d) neither upright nor inverted

221 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%

222 Among the following where do you think the process of decomposition would be the fastest?

(a) Tropical rainforest (b) Antarctic

(c) Dry arid region (d) Alpine region

223 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%

224 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

225 Climax community is in a state of

(a) non-equilibrium (b) equilibrium

(c) disorder (d) constant change

226 Among the following biogeochemical cycles, which one does not have loss due to the respiration?

(a) Phosphorus (b) Nitrogen

(c) Sulphur (d) All of these

227 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

228 The reservoir for the gaseous type of biogeochemical cycle exists in

(a) stratosphere (b) atmosphere

(c) ionosphere (d) lithosphere

229 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

230 Which one of the following types of ecosystem is expected in an area where evaporation exceeds precipitation, and mean annual rainfall is below 100 mm?

(a) Grassland (b) Shrubby forest

(c) Desert (d) Mangrove

231 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

232 Edaphic factor refers to

(a) water (b) soil

(c) relative humidity (d) altitude

233 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

Answers

Mastering NCERT with MCQs

1 (b)	2 (a)	3 (c)	4 (b)	5 (d)	6 (a)	7 (c)	8 (b)	9 (a)	10 (d)	11 (a)	12 (d)	13 (c)	14 (a)	15 (b)
16 (b)	17 (c)	18 (c)	19 (c)	20 (c)	21 (d)	22 (b)	23 (d)	24 (a)	25 (b)	26 (a)	27 (d)	28 (b)	29 (b)	30 (a)
31 (b)	32 (c)	33 (a)	34 (c)	35 (d)	36 (d)	37 (a)	38 (a)	39 (a)	40 (c)	41 (c)	42 (a)	43 (a)	44 (d)	45 (a)
46 (c)	47 (b)	48 (b)	49 (a)	50 (b)	51 (c)	52 (d)	53 (c)	54 (b)	55 (b)	56 (a)	57 (a)	58 (b)	59 (c)	60 (d)
61 (d)	62 (b)	63 (b)	64 (b)	65 (a)	66 (a)	67 (d)	68 (d)	69 (c)	70 (c)	71 (b)	72 (c)	73 (a)	74 (a)	75 (a)
76 (d)	77 (c)	78 (b)	79 (d)	80 (a)	81 (a)	82 (c)	83 (d)	84 (c)	85 (c)	86 (d)	87 (a)	88 (c)	89 (a)	90 (a)
91 (a)	92 (b)	93 (c)	94 (b)	95 (a)	96 (a)	97 (b)	98 (d)	99 (a)	100 (c)	101 (a)	102 (b)	103 (c)	104 (d)	105 (c)
106 (a)	107 (a)	108 (d)	109 (d)	110 (c)	111 (a)	112 (c)	113 (a)	114 (b)	115 (d)	116 (a)	117 (d)	118 (a)	119 (a)	120 (c)
121 (d)	122 (d)	123 (b)	124 (a)	125 (d)	126 (a)	127 (b)	128 (b)	129 (d)	130 (b)	131 (a)	132 (b)	133 (a)	134 (d)	135 (b)
136 (b)	137 (b)	138 (d)	139 (b)	140 (a)	141 (a)	142 (a)	143 (d)	144 (b)	145 (c)	146 (c)	147 (a)	148 (d)	149 (d)	150 (d)
151 (d)	152 (c)	153 (d)	154 (a)	155 (d)	156 (a)	157 (c)	158 (a)	159 (c)						

NEET Special Types Questions

160 (b)	161 (c)	162 (a)	163 (c)	164 (a)	165 (a)	166 (b)	167 (d)	168 (b)	169 (c)	170 (b)	171 (a)	172 (d)	173 (c)	174 (c)
175 (d)	176 (c)	177 (b)	178 (a)	179 (d)	180 (d)	181 (a)	182 (d)	183 (a)	184 (a)	185 (a)	186 (a)	187 (d)	188 (c)	189 (d)
190 (d)	191 (d)	192 (d)	193 (c)	194 (c)	195 (d)	196 (c)	197 (c)	198 (d)	199 (d)	200 (a)	201 (b)	202 (c)	203 (a)	204 (b)
205 (a)	206 (b)	207 (c)	208 (d)	209 (b)										

NCERT & NCERT Exemplar Questions

210 (a)	211 (b)	212 (a)	213 (b)	214 (c)	215 (a)	216 (c)	217 (b)	218 (b)	219 (b)	220 (c)	221 (b)	222 (a)	223 (b)	224 (a)
225 (b)	226 (d)	227 (d)	228 (b)	229 (c)	230 (c)	231 (d)	232 (b)	233 (d)						

Answers & Explanations

3 (*c*) The basic categories of ecosystem are aquatic and terrestrial. The terrestrial ecosystem could be forest, grassland, desert, etc. Whereas aquatic ecosystem are ponds, lake, sea, wetland, freshwater streams, estuaries, etc.

6 (*a*) Abiotic components refer to the non-living physico-chemical factors of the environment. These components not only affect the distribution and structure of organisms but also their behaviour and inter-relationships. Abiotic factors also include inorganic substances, organic compounds, climatic factors and edaphic factors.

7 (*c*) The biotic components of an ecosystem refer to all living organisms like plants, animals and microbes, etc.

8 (*b*) The vertical distribution of different species occupying different levels in a biotic community is known as stratification.
It is the formation of vertical layers where vegetation is dense, i.e. there are about 5-7 strata (layer) in the tropical rainforests with trees, occupy top vertical strata, shrubs (the second layer below tree), herbs and grass occupy the bottom layers.

9 (*a*) As stratification pattern change with latitude, it becomes more pronounced in tropical rainforest than temperate forests, deciduous forest or a savannah. This is probably due to the higher complexity of the vertical structure of tropical rainforests.

10 (*d*) Stratification represents the structural unit and is not the functional unit of ecosystem. Energy flow, productivity, decomposition and nutrient cycling are the functional unit of an ecosystem.

14 (*a*) The rate of biomass production is called productivity. It is expressed in terms of $gm^{-2}yr^{-1}$ or kcal m^{-1} yr^{-1}.

16 (*b*) Net primary productivity is equal to organic matter synthesised by photosynthesis minus utilisation in respiration and other losses. It can also be defined as the available biomass for the consumption to heterotrophs (herbivores and decomposers).

18 (*c*) Primary productivity depends upon availability of nutrients and photosynthetic capability of plants. Other factors which affect primary productivity are temperature, water, moisture, etc.

25 (*b*) Decomposers (saprotrophs) are the organisms that breakdown degrading dead organic matter or detritus into inorganic substances and in doing, so they carry out the natural process of decomposition.

26 (*a*) Upper layer of the soil has maximum detritus and thus decomposition is maximum there.

27 (*d*) Decomposition results in the production of dark brown, smelling, humus rich organic matter and inorganic substances like carbon dioxide, water and nutrients.

34 (*c*) Climatic conditions like temperature and soil moisture regulate decomposition through their effects on the activities of soil microbes.

37 (*a*) 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 sugars.

38 (*a*) Anaerobiosis inhibits or slow down decomposition process. It is the complete absence or loose of gaseous or dissolved elemental oxygen in a given place or environment. For decomposition, oxygen is required by detritivores (i.e. microorganisms). Thus, if there is the absence of oxygen, decomposition will be inhibited.

39 (*a*) Fragmentation is one of the steps during decomposition, in which detritus is converted into small fragments by the action of earthworm.

Rest of the options are incorrectly matched and can be corrected as

- Humification leads to the accumulation of dark coloured amorphous substance called humus that is highly resistant to microbial action and undergoes decomposition at an extremely slow rate.
- Catabolism is the set of metabolic pathways that breakdown the molecules into smaller units to release energy.
- Leaching refers to the loss of water soluble plant nutrients from the soil due to the rain and irrigation.

40 (*c*) PAR stands for Photosynthetically Active Radiation. The sun is the only source of energy for all ecosystems on earth. Out of the total incident solar radiation, only 50% of it is Photosynthetically Active Radiation (PAR). Plants capture only 2-10% of the PAR and this small amount of energy sustains the entire living world.

41 (*c*) The energy enters in any ecosystem through producers. The ultimate source of energy for biosphere is solar radiation, which is captured by producers through photosynthesis and stored as organic compounds.

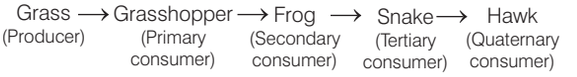
42 (*a*) The energy flow in an ecosystem is unidirectional. There occurs flow or transfer of energy from sunlight through plants and plant-eating animals to flesh-eating animals in the form of food.

44 (*d*) Ecosystems also follow second law of thermodynamics. They need a constant supply of energy to synthesise the molecules they require, to counteract the universal tendency toward increasing disorderliness.

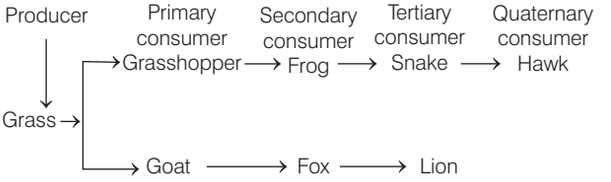
46 (*c*) All the animals that depend for food on plants (directly or indirectly) are called consumers. Consumers are divided into the following categories

- Primary consumers
- Secondary consumers
- Tertiary consumers

48 (*b*) Frog feeding on insects is secondary consumer.



49 (*a*) Insects (grasshopper) and cattles (goat) are dependent upon producers (grass), i.e. they are primary consumer.



50 (*b*) The food chain in the question is detritus as, it starts from dead material (animal or plant).

51 (*c*) A lion that eats zebra that ate grass is a secondary consumer because it feeds on primary consumer.

52 (*d*) A bear that eats a fish that further ate bugs that ate algae is a tertiary consumer.

54 (*b*) Vegetable eating person acts as primary consumers in an ecosystem. These are herbivores, which feed directly on producer (green plants).

55 (*b*) The common characteristics of earthworm, soil mites and dung beetle in an ecosystem is that they all are primary consumers (detritivores). Since a detritus food chain starts with detritivore which consume degrading dead organic matter or detritus. These are all primary consumers.

57 (*a*) Plants and phytoplanktons are producers. In a terrestrial ecosystem, plant grows by manufacturing food from carbon dioxide of air, water and minerals of soil with the help of chlorophyll and sunlight. Plants, thus act as the producer on land.

In a pond, phytoplankton (rooted and floating plants) synthesise food materials from dissolved nutrients by photosynthesis. They, thus act as the producers.

59 (*c*) The transfer of energy from producers to top consumers through a series of organisms is called food chain. It is always straight and proceed in a progressive straight line. In a food chain, the maximum population is of producers.

60 (*d*) Food chain starts with photosynthesis. The green plants always occupy first level in any given food chain and are commonly termed as the primary producers.

61 (*d*) The food chain consists of producers, consumers and decomposers. Consumers are often of 3-5 types

First order (Primary) — Herbivores
Second order (Secondary) — Primary carnivores
Third order (Tertiary) — Secondary carnivores
Fourth order (Quaternary) — Top carnivores

64 (*b*) In a terrestrial ecosystem, a much larger fraction of energy flows through the Detritus Food Chain (DFC) than through the Grazing Food Chain (GFC). DFC may be connected with the GFC at some levels. For example, some of the organisms of DFC are prey to the GFC animals.

65 (*a*) The correct flow of energy in an ecosystem is shown by

$$\underset{\text{(Autotroph)}}{\text{Grass}} \longrightarrow \underset{\text{(Herbivore or Primary consumer)}}{\text{Cow}} \longrightarrow \underset{\text{(Secondary consumer)}}{\text{Human}}$$

69 (*c*) In the given food web, there are following five food chains

- Plant → Deer → Python
- Plant → Grasshopper → Frog
- Plant → Goat → Lion
- Plant → Goat → Python
- Plant → Deer → Lion

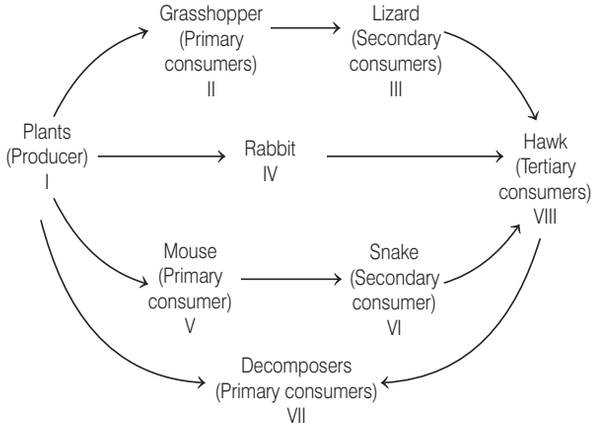
71 (*b*) In grazing food chain, frog (C) is a secondary consumer (primary carnivore) which preys upon herbivorous animals and eagle is top carnivore (A) which is not prayed upon by other animals because of their size, ability and ferociousness.

Detritus food chain (B) begins with detritus or dead organic matter. Primary consumers or detritivores (earthworms) feed over it.

Thus, option (b) is correct.

72 (*c*) Secondary consumers are those which feed on primary consumers, i.e. lizard and snake here.

73 (*a*) Option (a) is correct. Animals, which feed directly on plants, i.e. herbivores are primary consumers (grasshopper, rabbit and mouse).



76 (*d*) Option (d) is incorrect and it can be corrected as

Detritus chain account for more energy flow than grazing food chain.

77 (*c*) In an ecosystem, organism occupies a specific place in food chain is called trophic level. Every organism occupies a place in the natural surrounding or in a community according to their feeding relationship with other organisms.

Based on the source of their nutrition or food these organisms occupy a specific place in the food chain as I, II or III trophic levels.

78 (*b*) In grazing food chain, green plants (producers) constitute the first trophic level. In detritus food chain, wood louse constitutes the first trophic level.

79 (*d*) The organisms, which attack dead animals are present at the starting of food chain, e.g. detritus food chain and are known as decomposers (detritivores).

80 (*a*) Incorrect food chain is Grass → Frog → Vulture as frog is not a herbivore animal.

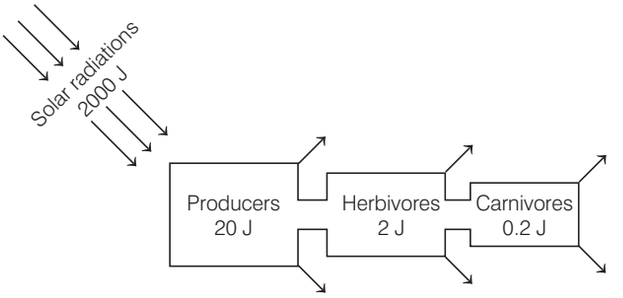
83 (*d*) The mass of living material at a trophic level at a particular time is called standing crop.

The standing crop is measured as the biomass of living organisms (biomass) or as the number of organisms in a unit area.

84 (*c*) The 10% law is related to the energy transfer from lower trophic level to the higher trophic level. The number of trophic levels in the food chain is restricted as the transfer of energy follows 10% law.

85 (*c*) The 10% law for enegy transfer in food chain was given by Lindemann in 1942. At each step of food chain when food enegry is transferred from one trophic level to the next higher trophic level only about 10% of energy is passed on to the next level.

87 (*a*) Only about 10% is stored at higher trophic level and the remaining 90% is lost in respiration, decomposition and waste in the form of heat. Suppose 2000 J of solar energy is incident on green vegetation. The latter having about 1% efficiency, trap about 20 J of energy and convert it into chemical energy by photosynthesis.



The remaining would be lost to the environment. The herbivore that feeds on producers get 10% of the energy stored in plants, i.e. 2 J. The remaining 18 J are lost to the environment. Carnivores feeding on herbivores would be able to store only 0.2 J of energy as flow.

88 (*c*) The tiger is left with 10J of energy in a grass → deer → tiger food chain. The energy available grass level is 100 J.

According to 10% law in the following food chain grasses → deer → tiger, if tiger have 10 J of energy then deer will have 10 time of this and grasses will have 10 times of deer, i.e. 1000 J.

89 (*a*) According to 10% law of energy flow, peacock will receive 0.02 J of energy as top consumer. Energy received by the organisms at different trophic level can be seen as follows

$$\text{Plant} \rightarrow 20\text{J}$$
$$\text{Mice} \rightarrow 20 \times 10\% = 2\text{J}$$
$$\text{Snake} \rightarrow 2 \times 10\% = 0.2\text{J}$$
$$\text{Peacock} \rightarrow 0.2 \times 10\% = 0.02\text{J}$$

93 (*c*) Human beings can function on three trophic levels. They are at

- Primary trophic level as primary consumer on plants.
- Secondary trophic level as secondary consumer.
- Tertiary trophic level as tertiary consumer.

94 (*b*) The upright pyramid of number is absent in forest. Pyramid of number represents the number of individuals per unit area at various trophic levels. It is always upright in grassland, pond and lake ecosystems. But in forest or single tree ecosystem, it is spindle-shaped and if parasitic food chain is considered, then it will be an inverted pyramid.

95 (*a*) The pyramid of biomass of lake or pond ecosystem is always inverted, where a large fish eat large number of small zooplanktons and pyramid of number in parasitic food chain is also inverted as single tree or a small leaf can support large number of parasites.

97 (*b*) Amongst all A, B and C representations, B shows the pyramid of grassland ecosystem in terms of number and biomass both. In this, a larger number of grass plants or herbs support a fewer number of animals at successive trophic levels. The same sequence will be followed in terms of biomass also.

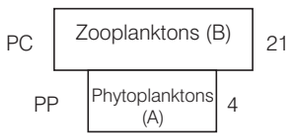
98 (*d*) Green plants → Insects → Frog → Snakes → Peacock

From the given food chain, it is clear that the peacock stands at the apex of this food ecological pyramid.

99 (*a*) The given figure shows spindle-shaped pyramid of number in single tree ecosystem. Here, a single, large-sized tree provides food to large number of herbivores, which in turn support a few carnivores and the later are eaten up by small number of top carnivores.

So, here PP is used for Primary Producer, i.e. single tree, PC is Primary Consumers, i.e. large number of insects, SC is Secondary Consumers, i.e. small insectivorous birds and TC is Top Consumers, which may be eagles or falcon, etc.

101 (*a*) Pyramid of biomass is inverted in a pond, where a large number of zooplanktons eats upon a small number of phytoplanktons.



102 (*b*) The figure represents pyramid of biomass which shows a sharp decrease in biomass at higher trophic level.

104 (*d*) Pyramid of energy always has a pyramidal shape that is decreasing values at higher trophic levels. Maximum energy content is present in producers. They obtain the energy from solar radiations. The energy is converted in chemical form and stored inside organic matter manufactured by the producers. As the energy passes into higher trophic levels along with food, its amount decreases because of its dissipation as heat and for performing various body activities.

106 (*a*) 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. Each bar in the energy pyramid indicates the amount of energy present at each trophic level in a given or annually per unit area.

107 (*a*) Pyramid of biomass is more real than the pyramid of number because the pyramid of number does not take into consideration the size of the individual. For example, mouse, rabbits, deer, antelope, elephant, etc., are all herbivores. The same amount of vegetation will support a large number of mice, fewer rabbits, still smaller number of deer and very few elephants. However, their total biomass shall be equal in all the cases and will be related to biomass of the vegetation.

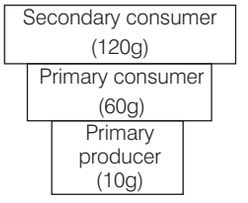
108 (*d*) The pyramid of energy is always upright for any ecosystem. This situation indicates the fact that herbivores have a better energy conversion efficiency than carnivores.

110 (*c*) Pyramid of biomass in sea is generally inverted because the biomass of a trophic level depends upon reproductive potential and longevity of its members. In a sea, the biomass of phytoplanktons is usually lesser than that of zooplanktons, while the biomass of carnivores is greater than small carnivores and zooplanktons.

On the other hand, pyramid of energy is always upright. Pyramid of biomass in terrestrial ecosystems (forests, grasslands) is also upright.

111 (*a*) Forest ecosystem has the maximum biomass, because it includes organisms of all trophic levels as compared to pond, lake or grassland ecosystem. Biomass refers to the amount of living organic matter. In forest ecosystem, productivity is also high that contributes to maximum biomass.

112 (*c*) An inverted pyramid of biomass will be obtained from the given data. The biomass is continuously decreasing from secondary consumer (120 g) to primary consumer (60 g) to primary producer (10 g). Therefore, upright pyramid of biomass cannot be obtained.



Inverted pyramid of biomass

113 (*a*) The gradual and predictable change in the species compositon of a given area is called ecological succession. During succession, some species colonies an area and their populations become more numerous, whereas populations of other decline and even disappear.

114 (*b*) Ecological succession is a sequence of series leading from baren land to the climax. In ecological terms, the developmental stages of a community are known as seral stages and the final stage as the climax community. The change is orderly and sequential. It is a long term process.

116 (*a*) Climax community is a stable, self-perpetuating and the final biotic community that develops at the end of biotic succession when the community finally reaches at equilibrium. It remains in perfect harmony with the physical environment and has a stable net productivity maximum diversity and niche specialisation.

123 (*b*) Primary succession is the development of communities that occurs on a previously unoccupied sites or primarily bare area, e.g. newly exposed sea floor igneous rocks, sand dunes, new cooled lava sediment, etc.

126 (*a*) Primary succession on rock starts with lichen species, e.g. Rhizocarpon, Rinodina and Lecanora. They produce some acid, which bring about weathering of rocks. That result into soil formation.

127 (*b*) In lithosere (xerosere or xerarch), foliose lichens make the conditions favourable for the growth of hardy mosses (e.g. *Tortula, Grimmia*). The pioneer community is usually constituted by crustose lichens (e.g. *Graphis, Rhizocarpon*), foliose lichens (e.g. *Dermatocarpon, Parmelia*) kill the crustose lichens by shading them, cause deeper depressions and accumulate more soil particles and organic matter.

128 (*b*) Secondary succession is a biotic succession that occurs in an area, which becomes secondarily bared due to the destruction of the community previously present there. In other words, secondary succession begins in area where natural biotic communities have been destroyed.

129 (*d*) The second stage of hydrosere is occupied by plants like *Vallisneria*. At second stage of hydrosere starts originating in a pond with colonisation of some phytoplanktons which forms the pioneer plant community. The stages are

Ist – Bacteria, blue - green algae and algae
IInd – *Hydrilla, Potamogeton* and *Vallisneria*
IIIrd – *Nelumbo, Nymphaea, Trapa, Azolla* and *Wolffia*
IVth – *Typha* and *Sagitaria*
Vth – *Juncus* and *Cyperus*
VIth – *Salix*, *Populus* and *Almus*.

130 (*b*) Secondary succession takes place on degraded forest. It is the process of regrowth of an ecosystem which undergone a destructive event such as fire, avalanche, agricultural clearing, deforestation or disease. The rate of succession and establishment of communities is faster as compared to growth in primary succession.

131 (*a*) Sucession level in xerarch (lithosere) are

- Lichen stage, e.g. crustose lichens followed by foliose lichens.
- Moss stage, e.g. *Tortula*, *Polytrichum*.
- Annual grass stage, e.g. *Cymbopogon*.
- Perennial herb and shrub stage, e.g. *Rubus*, *Capparis*, *Ziziphus*.
- Climax community, e.g. forest with herbs, shrubs and trees.

132 (*b*) Primary succession in water, the pioneer species are small phytoplanktons, e.g. diatoms, green flagellates, single-celled colonial or filamentous green algae.

133 (*a*) Xerarch succession is plant succession which takes place in dry area leading to a successional series from xeric to mesic conditions.

137 (*b*) The total amount of nutrients like carbon, phosphorus, calcium, etc., present in soil at any given time is called standing state. Standing state varies with the kind of ecosystem and season (time).

138 (*d*) The term nutrient cycle or biogeochemical cycle is used for the exchange/circulation of nutrients between the living and non-living components of the biosphere.

139 (*b*) In gaseous cycles, the main reservoirs of chemical are the atmosphere and ocean, e.g. carbon cycle, nitrogen cycle, oxygen cycle, etc.

141 (*a*) In a gaseous cycle, the element return to and is withdrawn from the atmosphere as a gas. The four most abundant elements in the living systems –H, C, O, N have predominantly gaseous cycles.

142 (*a*) The reservoir for the sedimentary cycle exists in earth's crust. Many environmental factors, soil, pH, moisture, temperature regulate release of these elements into the atmosphere.

144 (*b*) Phosphorus cycle is a sedimentary biogeochemical cycle. It describes the movement of phosphorus through the lithosphere, hydrosphere and biosphere and the main reservoir pool is lithosphere.

152 (*c*) Anthropogenic activities mainly deforestation is contributing a lot in disturbing the balance of carbon cycling in nature.

153 (*d*) The exchange pool in the carbon cycle is the atmosphere. In the gaseous cycle (carbon cycle), the reservoir in dissolved carbon form is in ocean.

154 (*a*) During weathering of rocks, minute amount of phosphorus dissolve in soil solution and are absorbed by plants through roots.

158 (*a*) I and IV are incorrectly matched. The correct information about them is as follows

- Nitrogen cycle is an example of gaseous cycle where the material involved in circulation between biotic and abiotic components of biosphere are gaseous. The reservoir pool is atmosphere. On the other hand, in sedimentary cycle, the reservoir pool is lithosphere and the circulating material is non-gaseous, e.g. phosphorus, sulphur, etc.
- The pyramid of biomass in aquatic environment, e.g. sea is inverted.

160 (*b*) Both Assertion and Reason are true, but Reason is not the correct explanation of Assertion.

AG Tansley coined the term ecosystem (Gr. *Eco*– environment; *system*— interaction and interdependent complex) for the first time. It is an integrated natural system resulting from the interaction of living and non-living factors of the environment. In other words, the ecosystem can also be defined as an inter-relationship between biotic (living) and abiotic (non-living) components of the environment.

161 (*c*) Assertion is true, but Reason is false. Reason can be corrected as

Bacteria and fungi are microorganisms which are decomposers. These decompose dead remains of plants and animals and release inorganic products into the environment. Thus known as microconsumers. Bacteria and fungi are not a part of living plants and animals.

162 (*a*) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

Consumers of first order are group of organisms including the herbivores. These directly eat upon green plants producers.

163 (*c*) Assertion is true, but Reason is false.

A network of food chains existing together in an ecosystem is known as food web.

Reason can be corrected as.

An animal like kite can be a part of food web as its a carnivore (tertiary consumer).

164 (*a*) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

Pyramid of energy is always upright because the flow of energy is unidirectional. All of the energy stored by the autotrophs in the form of food is available to the herbivores and then carnivores food.

165 (*a*) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

The pyramid of number of pond ecosystem is upright, because base of this pyramid is occupied by the maximum number of phytoplanktons (autotrophs) and number of individuals gradually decreases towards the primary and secondary consumers side, respectively.

166 (*b*) Both Assertion are Reason are true, but Reason is not the correct explanation of Assertion

Ecological succession means the natural development of a series of biotic communities, one after the other, in some area till a permanent climax community is established. A lake can become a dryland forest through ecological succession. Ecological succession can turn a bare rock into a forest with time.

167 (*d*) Assertion is false, but Reason is true. Assertion can be corrected as

Transfer of biogenetic nutrients (like carbon, phosphorus, sulphur, etc.) through abiotic and biotic components of an ecosystem is called biogeochemical cycle or nutrient cycle. Glucose is not a biogenetic nutrient.

168 (*b*) Both Assertion are Reason are true, but Reason is not the correct explanation of Assertion.

Carbon dioxide is almost certainly being absorbed by the oceans, which act as a global 'sink' for CO_2 . It is not clear how much more CO_2 the ocean can hold.

Human activities like deforestation, massive burning of fossil fuel for energy and transport has caused an increase in the amount of CO_2 in atmosphere.

170 (*b*) Statement I is false, but II is true. Statement I can be corrected as

The components of the ecosystem are productivity, decomposition, energy flow and nutrient cycling.

173 (*c*) Statement in option (c) is incorrect. It can be corrected as

In the successive seral stages, there is a change in the diversity of species of organisms, increase in the number of species and organisms as well as an increase in the total biomass.

Rest of the statements are correct.

175 (*d*) Statement II is incorrect and can be corrected as The solar input, the cycle of temperature, day length and other climatic conditions regulate the rate of function of the entire pond.

176 (*c*) Statement II is true, while I is false. The correct form of statement I is as follows

Decomposition rate is higher when detritus is enriched within nitrogen and water soluble substances like sugar.

177 (*b*) Statements I, II and IV are not correct, whereas statement III is correct. The incorrect statements can be corrected as

- Above ground detritus constitutes leaf litter, dried plant parts, remains of animals, their droppings and excretions.
- Below ground detritus mainly constitutes dead roots and underground dead animals.
- Humus is rich in lignin and cellulose.

178 (*a*) Statements II and IV are correct. Statements I and III are incorrect and can be corrected as

- Decomposition is an oxygen requiring process.
- Warm and moist environment favours decomposition.

183 (*a*) Statements I and II are incorrect and can be corrected as

- Plants form first trophic level in food chain.
- Herbivores form the second trophic level in the food chain.

184 (*a*) Statements I and II are correct, while statement III is incorrect. It can be corrected as

Energy for detritus food chain (not grazing food chain) comes from organic remain or detritus.

Grazing food chains are directly dependent on influx from solar radiations. Green plants with the help of solar radiation manufacture food by the process of photosynthesis.

185 (*a*) Statements I and II are correct, while statement III is incorrect. It can be corrected as

The energy for detritus food chain comes from dead organic matter not from sun.

186 (*a*) Statements I and II are true and statements III and IV are false. Statements III and IV can be corrected as

- The natural water connection of food levels does not form food chain. Food chain is the sequence of species or organisms through which the food energy (not water) pass in a community.
- Decomposers are also called saprotrophs.

189 (*d*) Statement in option (d) is incorrect and can be corrected as

The pyramid of energy is always upright never inverted in every case. It represents the total amount of energy utilised by different trophic level organisms in unit area over a period of time.

192 (*d*) Statements I, II and III are correct about limitations of ecological pyramids.

Statements IV and V are incorrect. These can be corrected as

- Ecological pyramids does not accommodate a food web.
- Only three types of pyramids, i.e. number, biomass and energy are relevant to the ecosystem study.

193 (*c*) Statements I and III are incorrect. These can be corrected as

- Pioneer community is the first biotic community to develop in a bare area.
- It comes and occupies an area from the outsides. In secondary succession, pioneer community develops from pre-existing occupants.

194 (*c*) The statement in option (c) is incorrect and can be corrected as

Carbon is released in the form of CO_2 (carbon dioxide) by respiration. The major component of phosphorus cycle is non-gaseous and there is no respiratory release of phosphorus.
Rest of the statements are correct.

195 (*d*) The incorrect statement about nutrient cycling is III and can be corrected as

Atmosphere only contains 1% of total global carbon.

211 (*b*) Zooplanktons are the second trophic level in a lake as they feed on microscopic plants or phytoplankton.

212 (*a*) Secondary producers are herbivores as they feed on plants (i.e. primary producers) and accumulate biomass.

214 (*c*) Decomposers (II and III) in option (c) are correct. Decomposers are heterotrophic organisms, mainly fungi and bacteria. They, meet their energy and nutrient requirements by degrading dead organic matter or detritus. Thus, are also known as saprotrophs (sapro means to decompose).

216 (*c*) Productivity is the rate of production of biomass or organic matter in any trophic level per unit area over a time period. It is expressed in term of $gm^{-2}yr^{-1}$ or $(kcal\ m^{-2})yr^{-1}$.

217 (*b*) In case of aquatic ecosystem like pond ecosystem, marine ecosystem, pyramid of biomass is inverted, because the biomass of fishes exceeds than that of phytoplanktons which make the small standing crop (first trophic level) of aquatic ecosystems.

218 (*b*) *Agaricus* is not a producer. It belongs to Basidiomycetes fungi which is a heterotroph (saprotroph). It is popularly called as mushroom. Whereas *Spirogyra*, is a green alga and an autotroph, i.e. producer *Nostoc* and *Volvox* are blue-green algae (cyanobacteria) and are also a producer (autotroph).

219 (*b*) The tropical rainforests are most productive in terms of productivity which are followed by coral reef, then estuaries, then desert and ocean.

220 (*c*) Pyramid of number in ecosystems can be inverted or upright. In terrestrial ecosystem, pyramid of number is upright. In case of successive decrease in members of trophic level like a big tree it is inverted.

222 (*a*) Moist and warm environment favour decomposition. Decomposition is largely an oxygen requiring process. Low temperature and anaerobiosis inhibit decomposition resulting in the build up of organic materials.

Thus, the decomposition would be the fastest in tropical rainforests.

223 (*b*) 10% of the primary productivity of a terrestrial ecosystem is eaten and digested by herbivores. Energy flowing in an ecosystem follows 10% law by Lindemann.

From the level of primary producers onwards only 10% of energy is stored at higher trophic level and 90% is lost (as heat or in respiration). This energy transfer forms the basis of life

$$\underset{(10\ J)}{\text{Producers}} \longrightarrow \underset{(1\ J)}{\text{Herbivores}} \longrightarrow \underset{(0.1\ J)}{\text{Carnivores}}$$

224 (*a*) During the process of ecological succession, the changes that take place in communities are orderly and sequential. The gradual and predictable changes in the species composition of a given area is called ecological succession.

225 (*b*) The climax community is in a state of equilibrium. During ecological or biotic succession, climax community is always stable, self-perpetuating and is the final biotic community. It is developed at the end of succession and is in state of perfect hormony and equilibrium with physical environment.

226 (*d*) Phosphorus, nitrogen and sulphur biogeochemical cycles do not have any losses due to the process of respiration, as these are not a part of respiratory pathways. While cycles like carbon and oxygen are affected by the process of respiration, as they are part of respiratory pathways.

227 (*d*) The sequences of communities of primary succession in hydrosere is

Phytoplankton (pioneer stage) → rooted submerged hydrophytes → floating hydrophyte (floating stage) → reed swamp → sedges → meadow and woodland (trees).

228 (*b*) The reservoir for gaseous type and biogeochemical cycle (nitrogen and carbon cycle) exists in atmosphere, while earth crust is the reservoir for sedimentry cycle. There are two stores of nutrients reserve pool and cycling pool.

The stratosphere, ionosphere and lithosphere are the parts of atmosphere.

229 (*c*) If the carbon atoms fixed by producers already have passed through three species, the trophic level of the last species would be tertiary consumer.

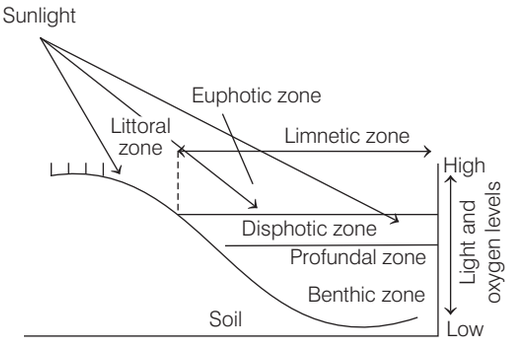
$$\text{Producer} \rightarrow \underset{\text{(Primary consumer)}}{\text{Ist Trophic level}} \rightarrow \underset{\text{(Secondary consumer)}}{\text{IInd Trophic level}} \longrightarrow \underset{\text{(Tertiary consumer)}}{\text{IIIrd Trophic level}}$$

230 (*c*) The desert type of ecosystem is expected in an area where evaporation exceeds precipitation and its mean annual rainfall is below 100 mm. It is characterised by extremely hot days and cold nights.

Evaporation from true desert always exceeds 7-50 times the precipitation (rainfall). Desert ecosystems of biomes are more in Northern hemisphere than Southern hemisphere.

231 (*d*) The littoral zone is the zone at the edge of a lake or ocean or in aquatic habitat which is alternatively exposed to air and immersed in water.

This costal zone is rich in producers from surface to bottom, with a large number of brown and red algae.



Different zones in aquatic ecosystem

232 (*b*) Edaphic factor refers to soil and its related properties texture, background, mineral, its topography and pH value, etc.

Other options are

Water, relative humidity and altitude are other abiotic components of an ecosystem, but affects the climatic conditions, hence are climatic factors. The variations in these factors affect the ecosystem and these factors are also the deciding factor of the different types of ecosystem found on earth.