Ecosystem

Introduction

- A.G.Tansley The term "Ecosystem" was coined by A.G. Tansley.
 According to Tansley Ecosystem is symbol of structure and function of nature.
- E.P.Odum Father of ecosystem ecology.

According to E.P.Odum - Ecosystem is the smallest structural and functional unit of nature or environment.



- **Definition:** Total living (biotic) and non-living (abiotic) components of the environment present in a particular area create an ecosystem.
- In any ecosystem, communities or living organisms interact with their physical environment in such a way that there is a well-defined flow of energy forming clear **trophic** (food) **levels** and **material cycles** within this ecosystem.
- Ecosystem is normally an open system because there is a continuous and variable entry and loss of **energy** and **materials**.
- An ecosystem may be small like a drop (Nano ecosystem) of water and as large as sea or tract of forest.
- An ecosystem may be temporary as a fresh water pool or a field or permanent like a forest or sea.
- Any ecosystem must have the following peculiarities.:
- There is an energy source for all living organisms in an ecosystem.
- Adequate amount of food and essential nutritional element should be present for living organisms in an ecosystem.
- There should be a continuous flow of energy and materials in form of food chains between organisms and environment.
- There are regular changes in the climatic conditions (temperature, humidity, light etc.) in an ecosystem.
- The boundaries of ecosystem are indistinct and have a overlapping character over each other.
- Ecosystem is the smallest structural and functional unit of nature or environment. It is a **self** regulatory and **self sustaining unit**.

Types of Ecosystem

(A) Natural Ecosystem

(B) Artificial Ecosystem

(A) Natural Ecosystem:

(a) Terrestrial Ecosystem:

eg. forest, grassland, tree, desert ecosystems.

(b) Aquatic Ecosystem:

Aquatic ecosystem is again of two type-

- (i) Lentic ecosystem: Stagnant fresh water, lake, pond, swamp.
- (ii) Lotic: Running fresh water ecosystem. eg., rivers
- (B) Artificial Ecosystem: Man made eg., cropland, Gardens etc.

On the basis of size, type of ecosystem:

- (a) Mega ecosystem- Ocean/Sea
- (b) Macro ecosystem Forest
- (c) Microecosystem Pond
- (d) Nano ecosystem Drop of water.

Components of Ecosystem:

(A) Abiotic Component

(B) Biotic Component

Abiotic Component:

- Temperature
- Light
- Soil
- Climate
- Rainfall etc.

Biotic Component:

• Formed by living things. eg., plants, animals, microbes.

Type of Biotic Components

1. Primary Producers:

- All photosynthetic organisms are primary producers. They prepare their own food. The green plants are the main producers. In the process of photosynthesis, producers absorb solar energy and convert it into chemical energy so producers are also called transducers or converters.
- Energy enters into the ecosystem through these primary producers. The **solar energy** is the only ultimate source of energy in ecosystem. This energy is available for the remaining living organisms. Ex. Grasses, Trees, Phytoplankton's.

- So key aspect of function of ecosystem are -(A) Productivity (B) Decomposition

 - (D) Nutrient cycling
- (C) Energy flow

Other eg. of Producers are:

- **Chemoautotrophs:** (iron bacteria, sulphur bacteria, nitrifying bacteria)
- In Aquatic Ecosystem: Floating plant called phytoplankton are the major autotrophs.

2. Consumer:

• All the heterotrophs of the ecosystem are known as consumers. They directly (herbivores) or indirectly (Carnivores) depend on the producers for food.

Type of Consumer:

- (i) Macroconsumers
- (ii) Microconsumers

(i) Macroconsumers (Phagotrophs or Holozoic):

• They digest their food inside the body. ie., first **ingestion** then **digestion**.

Macroconsumers are of following types:

(a) **Primary Consumers:** Such living organisms which obtain food directly from producers or plants are known as primary consumers.

eg., Herbivores: Grasshopper, Zooplanktons, Cow, Grazing Cattle, Rabbit.

- They are also known as **secondary producers** as they synthesize complex materials in the cells, by the digestion of food which is obtained from the plant.
- (b) Secondary Consumers or Primary Carnivores: Animals which feed upon primary consumers and obtain food. eg., Dog, Cat, Snake
 - The organism which completely depends on **dead animals** are not example of predators but they are the **scavengers** or **detrivores**. eg., Vulture, Crow, Fox.
 - All the herbivores are predators.
 - All the carnivores are not predators like scavengers.
- (c) Top Consumers: Those animals which kill other animals and eat them, but they are **not killed** & and **eaten** by other animal in the nature. eg., Lion, Man, Hawk, Peacock.



(ii) Microconsumers/Decomposers or Saprotrophs/Osmotrophs:

- Those living organisms which decompose the dead body of producers and consumers are known as **decomposer** or **reducers** or **transformer** or **osmotrophs**.
- The main decomposers in ecosystem are **bacteria** and **fungi**.
- Decomposers play a significant role in **mineral cycle.** Decomposers are responsible for converting complex organic material of dead animals or plants into simpler organic matter through the process of decomposition and release mineral substances into the soil where these are reused by the producers. So that soil is considered as the best resource of minerals.
- In Bacteria and fungi, process of decomposition completely takes place outside the body. They release enzymes from their body on dead remains and decompose it into simpler organic substance and then absorb it so these are called as **osmotrophs (absorptive)**.
- Vulture is a scavenger but not predator because it never kills any animal.

Special Points

Functions of Ecosystem:

• Plant parasites are known as primary consumers while animals parasites

(E. coli bacteria, Entamoeba histolica, liver fluke, tapeworm) are known as **secondary consumers.**

- All the insectivorous plants play the double role i.e., producer as well as secondary consumer because they synthesise their own food through photosynthesis and they eat insects simultaneously.
- Man and peacock are omnivores.
- Organisms which use **milk** or **curd** are known as **secondary consumer**.
- Sparrow occupy two trophic level -
 - (i) Primary consumer-as eating seeds,

(ii) Secondary consumer-as eating insects.

• Frog - (i) Larva - Herbivore, (ii) Adult - carnivore

Structure and Function of Ecosystem

Structure of Ecosystem:

- Biotic and abiotic components are physically organized to provide characteristic structure to a ecosystem
- Species composition and stratification (lake stratification, forest stratification, ocean stratification) is the part of structure of ecosystem.
- Another way to represent the structure of ecosystem is through food relationship of producers and consumers.

Food Chains:

- In ecosystem every heterotrophic organism depends on other organism for food material and all organism are (herbivores to carnivores) arranged in a series in which food energy is transferred through repeated eating and being eaten. It is called food chain. In food chain, energy flow is in the form of food.
- In a food chain, food material or food energy is transferred from one trophic level to next trophic level.
- Four trophic levels are present in the ecosystem, because level of energy decreases during the flow of energy from one trophic to the another trophic level.

| First trophic level [T₁] | = | Producers |
|---|---|---------------------|
| Second trophic level [T₂] | = | Primary consumers |
| Third trophic level [T₃] | = | Secondary consumers |
| Fourth trophic level $[T_{4}]$ | = | Top consumers |

- **Five trophic levels** found in highly complex ecosystem in which tertiary consumer is present in between the secondary consumers and top consumer. Then the fifth trophic level (T₅) is formed by the top consumer.
- In food chain energy flow is **unidirectional** (producers to herbivores).
- Generally the decomposers (Bacteria and Fungi) are not included in the food chain (Grazing food chains).

(C) Energy Flow:

- Energy flow is the key function of ecosystem. The storage and expenditure of energy in ecosystem is based on the two basic laws of **thermodynamics**.
 - (i) Energy is neither created nor destroyed but only transformed from one state to another state.
 - (ii) The law of entropy The transfer of food energy from one to another organisms leads to loss of energy as heat due to metabolic activity.
 - Energy in food is in concentrated form, heat energy is highly dispersed. It must be understood that all changes in energy forms can be accounted for energy flow in any system.

Food Flow Model:

- A simplified representation of energy flow through ecosystem has been made in figure presented. Two aspects with respect to energy flow in ecosystem need careful consideration. First, **the energy flows one ways**, i.e., form producers to herbivores to carnivores; it cannot be transferred in the reverse direction.
- Second, the **amount of energy flow decreases with successive trophic levels.** Producers capture only a small fraction of solar energy and amount of energy flow decreases with successive trophic levels. Producers capture only a small fraction of solar energy (1-5 percent of total solar radiation), and the bulk of unutilised energy is dissipated mostly as heat. Part of the energy capture in gross production their standing crop (respiration) and for providing food to herbivores (herbivory). The unutilised net primary production is ultimately converted to detritus, which serves as energy source to decomposers.

- Thus, energy actually used by the herbivore trophic level is only a small fraction of the energy captured at the producer level. On an average, in different ecosystems, the herbivore assimilation or productivity approximates 10 percent of gross productivity of producers.
- The energy assimilated by the herbivores is used in respiration and a fraction of unassimilated energy is transferred to decomposers (eg., Faecal matter). The remaining herbivore level energy available at carnivore trophic level is again partitioned leaving a very small fraction to support the next trophic level (top carnivore).
- The respiration cost also increases sharply along successive higher trophic levels. On an average, respiration in producer consumes about 20 percent of its gross productivity. Herbivores consume about 30 percent of assimilated energy in respiration. The proportion of assimilated energy consumed in respiration rises to about 60 percent in carnivores. Because of this tremendous loss of energy at successive higher trophic levels, the residual energy is decreased to such an extent that no further trophic level can be supported. Therefore, the **length of food chains in an ecosystem** is generally **limited to 3-4 trophic levels**.



Fig.: A generalized energy flow model of ecosystem : Boxes represent biotic components and the arrows show the pathways of energy transfer; SR-Solar radiation: GP-Gross primary productivity; A-Assimilation; R-Respiration; NU-Not utilised; NA, Not assimilated

Types of Food Chains:

- In nature three type of food chain are present
- Grazing Food Chain or Predatory Food Chain: Most of food chain in nature are of this type. This food chain begins with Producers (plants) and in successive order it goes from small organism to big organism.

Aquatic Ecosystem:

| Producer | Pri. Consumer | Sec. consumer | Top consumers |
|---------------------------------|----------------|--|---------------|
| ↑ | ↑ | 1 | ↑ |
| Phytoplankton \longrightarrow | Zooplankton — | \rightarrow Small fish \longrightarrow | Large fish |
| \downarrow | \downarrow | \downarrow | \downarrow |
| T ₁ | T ₂ | T ₃ | Т4 |

Grass land ecosystem:

| Producer | Pri. Consumer | Sec. consumer | Top consumers |
|-------------------------|--------------------------|-----------------------|----------------|
| ↑ | ↑ | ↑ | ↑ |
| $Grass \longrightarrow$ | Rabbit \longrightarrow | $Fox \longrightarrow$ | Lion |
| \downarrow | \downarrow | \downarrow | \downarrow |
| T 1 | T ₂ | T ₃ | T ₄ |

Grazing food chains are directly dependent on **solar radiation** (as a primary source of energy) and have **rapid energy flow.**

2. Detritus Food Chain or Saprophytic Food Chain: This food chain begins with decomposition of dead organic matter by **decomposers** so it is also known as saprophytic food chain. In this food chain primary consumers are bacteria and fungi.

Detrivores acts as major conduit for energy flow.

Dead organic matter \rightarrow Bacteria, fungi

- In mangrove vegetation this food chain goes up to big organism.
- Dead mangroves leave → Bacteria & fungi → Amphipds, molluscs, crabs, nematodes → small fishes
 → fish eating birds.
- It does not directly depends on **light.**
- In an aquatic ecosystem, GFC (Grazing Food Chain) is the major conduit (source) of energy flow. As against this, in a terrestrial ecosystem, a much larger energy flow through the detritus food chain (as it is small) than through the grazing food chain, **as in terrestrial ecosystems GFC gets connected with DFC**.
- Maximum 3-4 trophic levels are possible in both GFC & DFC.

Food Web

- In big ecosystem many food chains are interlinked together on different trophic levels to form food web. In food web transfer of food energy is unidirectional but from many different alternative pathways.
- In food web members of a particular trophic level obtain their food according to their choice and taste but that type of facility is not present in food chain. It means they have **more than one option or alternative for getting food.**

• As much as food web is complex that ecosystem is more permanent or stable, such type of ecosystem is not destroyed naturally and continues for long time. Such ecosystem is not affected by loss of any organism of any particular trophic level. Those ecosystems which have simple food web are not very stable.



Homeostasis:

Ecosystem is a dynamic system because continuous interaction is going on in between aboitic and biotic components so ecosystem is present in equilibrium position. Ecosystem is also self maintainable and self-regulatory system, it means an ecosystem maintains a balance in between different trophic levels. Each trophic level controls the other trophic level in an ecosystem. If any change takes place in any trophic level of ecosystem, the other trophic levels of this ecosystem may react according to it. So ecosystem always remain in equilibrium. This feature of system is known as **Homeostasis**

Pyramids of Ecosystem

• Graphical representation of ecological parameters at different trophic levels and trophic structure in ecosystem is called pyramids. These parameters are **Number**, **Biomass** and **Energy**. First of all, ecological pyramids were formed by **Charis Elton;** thus also referred as **Eltonian pyramids**.

These Pyramids are of three types:

- (1) Pyramids of Number,
- (2) Pyramids of Energy,
- (3) Pyramids of Biomass.

(1) Pyramid of Number:

 In this type of pyramid the number of organisms in various trophic levels are shown. These pyramids are mostly upright, because number of producers [T₁] is maximum and number of herbivores and carnivores decrease towards apex or at successive trophic levels, such as Grassland ecosystem and aquatic ecosystem.



figure: Pyramid of numbers in a grassland ecosystem. Only three top-carnivores are supported in an ecosystem basd on production of nearly 6 millions plants

• In a tree ecosystem the pyramid of numbers is Spindle / inverted.

Tree Ecosystem

• Maximum number of producers are present in aquatic ecosystem. The number of organism at any trophic level depends upon the availability of organisms which are used as food on lower level so availability of food is main factor.

(2) Pyramid of Energy:

• It represents amount of energy at different trophic levels, energy pyramids are **always upright or erect** because there is a gradual decrease in energy at successive trophic levels. According to the **10% law of Lindeman**, the 90% part of obtained energy of each organism is utilized in their various metabolic activities and heat and only 10% energy is transferred to the next trophic level.



Figure: An ideal pyramid of energy. Observe that primary produces convert only 1% of the energy in the sunlight available to them into NPP

(3) Pyramid of Biomass:

• Pyramid of biomass represents the total amount of biomass of each trophic level of ecosystem, mostly these pyramids are also **upright (erect)** eg., **tree ecosystem, forest ecosystem.**



figure: Pyramid of biomass shows a sharp decrease in

biomass at higher trophic levels

• Pyramid of biomass in **aquatic ecosystem** is **inverted** because in it producers are microorganism and their biomass is very less.



figure: Inverted pyramid of biomass-small standing crop of phytoplankton

supports large standing crop of zooplankton

Limitations of Ecological Pyramids:

- It does not take into account the same species belonging to two or more trophic levels.
- It assumes a simple food chain, something that almost never exists in nature. It does not accommodate a food web.
- Saprophytes are not given any place.
- **Standing Crop:**In unit area, unit time, given environmental conditions, the total amount of living/organic matter present in an ecosystem.
- **Standing State:**In unit area, unit time, given environmental conditions, the total amount of nonliving, inorganic matter (C, H, O, N, P, S etc.) present in an ecosystem.

Productivity

There are two type of productivity present

(i) Primary Productivity:

- Primary production is defined as 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 or energy. The rate of biomass production is called productivity. It is expressed in terms of gm⁻²yr⁻¹ or Kcal m⁻²yr⁻¹ to compare the productivity of different ecosystem. It can be divided into GPP and NPP.
 - (a) Gross Primary Productivity (G.P.P.): It is the total amount of energy fixed (organic food) in an ecosystem (in producers) in unit time is called G.P.P. includes the organic matter used up in respiration during the measurement period. It is also known as total (Gross) photosynthesis. A considerable amount of GPP is utilised by plants in respiration.

(b) Net Primary Productivity (N.P.P.): It is the amount of stored organic matter in plant tissues after respiratory utilisation by plants.

NPP = GPP - R (R = Respiration + Metabolic activities) or GPP = NPP + R

- NPP is the available biomass for the consumption of heterotroph.
- (ii) **Secondary Productivity:** Secondary productivity is the rate of formation of new organic matter by consumers.
- (iii) Net Community Productivity or Net Productivity: The rate of storage of organic matter not used by the heterotrophs.

NCP = N.P.P. – HR (HR = Energy used by Heterotrophs or consumers)

- Primary productivity depends on the plant species inhabiting a particular area. It also depends on a variety of environmental factors availability of nutrients and photosynthetic capacity of plants. Therefore, it varies in different type of ecosystem. The **annual net primary productivity of the whole biosphere is approximately 170 billion tons (dry weight) of the organic matter**, productivity of the **ocean are only 55 billion tons**.
- In per unit area maximum productivity found in tropical rain forest.
- In water, least productive ecosystem is very deep lakes and highly productive ecosystem is coral reef.
- Nitrogen is the limiting factor in ocean and phosphorus is the limiting factor in lake productivity.
- In land Highest productivity, Tropical rain forest.

Lowest productivity is of Deserts, tundra.

• Most productive Agro-ecosystem is Sugarcane and rice ecosystem.

Abiotic Factors

(A) Light:

- It is a complex physical environmental factor. Light is measured by **luxmeter or photometer.** It is a electromagnetic spectrum.
- In solar radiation wavelength (λ) of light or visible spectrum is **400-700 nm**, it is also called **photosynthetically active radiation (PAR)**

Albido Value:

- The ability of a surface to reflect the incoming radiation is called albido value (AV) it is 80% for fresh snow, 20-30% for sand, 5-10% for the forest.
- Out of the total sun light only 1-5% is utilised in photosynthesis.
- Only 2-10% of PAR is utilised by plant in photosynthesis.
- Many species of small plants (herbs and shrubs) growing in forests are adapted to
 photosynthesize optimally under very low light conditions because they are constantly
 overshadowed by tall, canopied trees. Many plants are also dependent on sunlight to meet their
 photoperiodic requirement for flowering. For many animals too, light is important in that they
 use the diurnal and seasonal variations in light intensity and duration (photoperiod) as cues for
 timing their foraging, reproductive and migratory activities. The availability of light on land is
 closely linked with that of temperature since the sun is the source for both. But, deep (>500m)
 in the oceans, the environment is dark and its inhabitants are not aware of the existence of a
 celestial source of energy called Sun. What, then is their source of energy?.

(B) Temperature:

- It is most important factor affecting organisms.
- Factors which mainly affect the temperature are latitude and altitude.
- Temperature has significant effect on climatic conditions, growth responses of plants, activities of organisms.
- Temperature also affects plant, animal distribution in aquatic ecosystems like in lake.

Effect of Temperature on Morphology of Animals:

- Temperature affect the absolute size of an animal and its body parts.
 - 1. Bergman Rule: Birds and mammals attain greater body size in cold region and lesser in warm region.
 - 2. Allen's Rule: The tail, ears, limbs, snout and hair of birds and mammals are smaller in colder region and larger in warm region.

Effect of Temperature on Physiology:-Adaptations in Animals

• The environmental conditions of a habitat are not always constant but change with time. The organisms show various kinds of **Adaptations** to cope with changed abiotic or environmental conditions.

Acclimatisation:

- Acclimatisation is a gradual physiological adjustment of the organism to the slowly changing new environmental condition. If there is a shift in some environmental factor beyond the tolerance range of an organism the latter can come to the resting stage or migrate or can undergo acclimatisation.
- In the polar sea aquatic mammals like **seals** have a **thick layer** of fat (blubber) below their skin that acts as an **insulator** and **reduces loss of body heat.**
- Some organisms possess adaptations that are physiological which allow them to respond quickly to a stressful situation. If you had ever been to any high altitude place you must have experienced what is called **altitude sickness.** Its symptoms include nausea, fatigue and heart palpitation.
- This is due to the low atmospheric pressure at high altitudes, body does not get proper oxygen. In human beings the body compensates low oxygen availability by increasing red blood cells (RBC) production, decreasing the binding capacity of haemoglobin for O₂ and by increasing breathing rate.

Adaptations to Water Scarcity:

- Two types of adaptations are prominent in animals living in **arid regions.** viz. lowering of water loss as much as possible and adapting to arid conditions.
- For example, the **kangaroo rat** conserves water by excreting solid urine, and can live from birth to death without even drinking water (By oxidation of fat). The camels show unique adjustments to desert conditions, being very economical in water use, tolerant to wide fluctuations in body temperature, and are able to maintain blood stream moisture even during extreme heat stress.

Adaptations of Cold:

• Sessile animals, such as **barnacles** and **molluscs**, living in very cold inter-tidal zones of northern shores, and several insects and spiders resist the effect of cold spells by a process known as **cold hardening**.

Cold Hardening:

- Physiological and biochemical process by which an organism prepares for cold weather. These are some means of cold hardening:
- Some freeze-avoiding animals can tolerate environmental temperatures below 0°C by accumulating **glycerol** or **antifreeze proteins** that lower freezing point of their body fluids. Presence of such antifreeze compounds allows the **fish in Antarctica region** to **remain active in sea water**.
- In **plants (hekistotherms)** cell release water in inter cellular spaces and **increase sugar** storage in **protoplasm** which **decrease the freezing point**.

Response of Organism to Abiotic Factors

Shelford Law of Tolerance:

- Every organism has minimum and maximum limit of tolerance (ecological amplitude) with respect to the environmental factor like temperature, sunlight or nutrient concentration. In between these limits the central optimum range is found in which organisms are abundant this is known as optimum zone of tolerance.
- The range of demands (requirements), and range of tolerance of a species called ecological amplitude.
- If a species posses low ecological amplitude it is less adapted and if high ecological amplitude then more adapted to environment.
- Community is formed by organisms of almost same ecological amplitude.



On the basis of temperature tolerance range animals divide into two groups:

(1) Eurythermal:

Organisms which are able to tolerate wide variation of temperature. eg., Birds, Man, etc.

(2) Stenothermal:

Organisms which can tolerate narrow range of temperature. eg., Arctic fishes, Reptiles, Amphibians.

- The organisms have ability to maintain the internal body environment suitable for all biochemical and physiological function to proceed with maximal efficiency and increase the fitness of the species.
- Regulation could be in terms of internal body temperature and osmotic concentration of body fluid.
- Organisms show two means to regulates their internal body environment with changing external environment.
 - (1) **Regulators/Regulates**

(2) Conformers/Conforms

(1) Regulators / Regulates:

- Organisms which can maintain homeostasis by **physiological** (Sometime behavioural/physical methods may also help) **means** and maintains constant body temperature.
- All birds and mammals, some lower invertebrates and vertebrates.
- For example, human beings and other mammals maintains their constant body temperature (for humans 37°C) in summer by sweat results in cooling and in winter by shivering. Which produce heat and raise body temperature.

(2) Conformers:

- Organisms which are not able to maintain their internal environment (**Temperature**, osmotic concentration) means their body temperature change with change in temperature.
- About 99% of animals and most plants are conformers.
- These organisms do so, as the thermoregulation is energetically expensive for many organisms.
- The heat loss or heat gain is function of surface area. Since small animals have larger surface area relative to their volume, they loss body heat very fast when it is cold outside. So they have to expand much energy to generate body heat through metabolism. e.g. Shrews and humming bird. That's why small animals are rarely found in polar region or animals are large in size, in polar region.
- Some species have evolved the ability to regulate, but over a limited range at environmental conditions, beyond which they are conform called **partial regulators.**
- If stressful external conditions are localized or remain only for a short duration then some organisms show migration and suspension.

Effect of Temperature on Behaviour:-

Migration:

- The organisms can move away temporarily from stressful habitat to more suitable area and returns when stressful period is over.
- For example, birds migration. **Keoladev National Park** of Bharatpur Rajasthan hosts thousands of migratory birds coming from **Siberia** and other extremely cold northern regions during winter season.

Thermal Migration: Thermal migration has been seen in birds (Siberian cranes, arctic tern), mammals (Bison, caribou), fishes (salmon) etc.

• Migration may occur in search of food (Bison, caribou) or to complete reproductive cycle more effectively (siberian cranes).

| Type of migration | Examples | Activities |
|-------------------|----------------|---|
| Long-distance | Arctic tern | Nests close to north pole in summer. Flies from North (Arctic) to Antarctica in autumn and returns to |
| | | Norur pole again each spring. |
| Short-distance | Caribou, | Migrates in search of food each winter to warmer place. |
| | Elk and whale | |
| Periodic | Locust (Tiddi) | • Large population migrate in search of feeding grounds. |

Some examples of migration (Behavioural adaptation)

Note : Thermal Migration – Thermal migration has been seen in birds (siberian cranes, arctic tern), mammals (Bison, caribou), fishes (salmon) etc.

Suspend:

- In bacteria, fungi, lower plants, various kind of thick-walled spores are formed which help them to survive unfavourable condition and germinate on return of favourable condition.
- In higher plants seeds show suspended stage of plant life.
- In animals **hibernation** (winter sleep) shown by bears, frogs, during winter. While **aestivation** (summer sleep) shown by some fishes & snails in summer which is mode of time escape or suspension.



- Hibernation: Winter sleep or period of dormancy
 - (i) Cold blooded animals e.g. Amphibians, reptiles
 - (ii) Warm blooded animals e.g. Polar bear, North ground squirrels
- Aestivation (Summer sleep): Escape from heat of sun e.g. Lung fishes, Snails, Ground squirrels in south-west desert

- **Diapause:** Delay in development or morphogenesis of larva, embryos in response to regularly and reoccurring period of adverse environmental conditions. It is Physiological state of dormancy found in some arthropods, insects, and oviparous fishes.
- In unfavourable conditions many zooplanktons species in lakes and ponds enter in stage of suspended development called **diapause.**

Hibernation and Aestivation:

• In **very cold** or **dry environments**, animals incapable of migration shift to a physiological dormant state. Spending winter in dormant condition is called **hibernation**. On the other hand, spending the dry-hot period in an inactive state is known as **aestivation**. (Examples are shown in table)

| Туре | Examples | Precesses and activities |
|-------------|---|--|
| Hibernation | Northern ground squirrels, polar bear, cold blooded-Amphibian, Reptiles | True hibernators go into sleep during winter; body temperature drops; breathing and heartbeat become slow. |
| Aestivation | Ground squirrels in south-west deserts, lung fishes, snails. | Avoids heat by spending dry-hot period in a torpid state into burrows. |

(C) Soil:

- Soil is the upper most weathered layer of earth's crust.
- Soil is formed when rock are weathered in place or transported sediments are deposited by water and wind erosion. It is formed due to interaction among parent rock, climate, living organism, time and topography.
- Soil plays important role in plant growth by providing water, nutrients and anchorage. It support growth of plants, crops, grassland and forest.
- The mineral composition of soil depends upon the **minerals in the parent material** and the **extent** of **weathering**.

Soil Mineral Matter:

• Soil is the upper most layer of earth's crust formed by weathering of rocks. It is the mixture of living and non living material.

Minerals 45% + Water 25% + Air 25% + Organic matter (Living + Non-living) **5%** Soil formation is slow process 1 inch soil is formed in 500-1000 years.

• As a result of weathering the mineral particles of different size are formed. The soil is divided into five types on the basis of size of soil particles.

| 30 | il Type | Size of particle | s |
|------|--------------|-------------------|----|
| Cla | iy | less than 0.002 m | nm |
| Silt | | 0.002 - 0.02 mm | n |
| Fin | e sand | 0.02 - 0.20 | |
| Coa | arse sand | 0.20 - 2.0 | |
| Gra | avel or Grit | 2mm – 5mm | |
| Coa | arse Gravel | Above 5.00 | |

- Edaphic Soil related
- Edaphology Soil science
- Best Soil Loam (mixture of clay and sand particles)
- Best Soil pH 5.5 6.5

Soil Organic Matter:

• freshly fallen plant matter (litter) and dead animal material are together called **detritus**. The decomposition of detritus leads to the formation of humus in soil.

Decomposition

- Decomposition (Formation of Humus): Decomposers break down complex organic matter into inorganic substance like carbon dioxide, water and nutrients and the process is called decomposition. Dead plant remains such as leaves, bark, flower (litter) and dead remains of animals, including faecal matter, constitute **detritus**, which is the raw material for decomposition. The important steps in the process of decomposition are **fragmentation, leaching, catabolism, humification and mineralisation.**
- Detritivores (eg, earthworm) break down detritus into smaller particles. This process is called **fragmentation**.
- By the process of **leaching**, water soluble inorganic nutrients go down into the soil horizon and get precipitated as unavailable salts.
- Bacterial and fungal enzymes degrade detritus into simple inorganic substance. This process is called as **catabolism.**
- It is important to not that all the above steps in decomposition operate simultaneously on the detritus. **Humification and mineralisation** occur during decomposition in the soil. Humification leads to accumulation of a **dark coloured amorphous** substance called **humus** that is highly resistant to microbial action and undergoes decomposition at an extremely slow rate. Being colloidal in nature it serves as a reservoir of nutrients. The humus is further degraded by some microbes and release of inorganic nutrients occurs by the process known as **mineralisation**.
- Decomposition is largely an oxygen-requiring process. The rate of **decomposition is controlled by chemical composition of detritus** and **climatic factors**. In a particular climatic condition, decomposition rate is **slower** if detritus is **rich in lignin** and **chitin** and **quicker**, if **detritus is rich in nitrogen** and **water-soluble substances like sugars**.
- **Temperature** and **soil moisture** are the most important climatic factors that regulate decomposition through their effects on the activities of soil microbes. Warm and moist environment favour decomposition whereas low temperature (< 10°C) and an anaerobiosis inhibit decomposition resulting in build up of organic materials.
- Decomposition requires years at very high altitude or latitudes. Rate of decomposition is low in prolonged dry soil like in tropical desert.

The actual rate of decomposition depends on **environmental conditions** and **detritus quality.** Soil Profiles:

- A₀₀ layer is rich in freshly fallen leaves (litter).
- A₀ layer is rich in partially decomposed organic matter (duff).
- A₁ layer is rich in fully decomposed organic matter (humus).
- A₂ layer is rich in minerals and also termed as zone of leaching.



Fig. Diagrammatic representation of the soil profile showing the five horizons

(D) Water:

- The only inorganic liquid occurring on earth which can functions as a resource, condition and habitat.
- Water regulates the climate through it's role in rainfall distribution and temperature modification.
- It also affects vegetation type and it's composition.
- The hydrological cycles regulates movement of water between aquatic systems, air and land.
- Salinity of water Sea water : 30-35 ppt

Maximum salinity- in hypersaline lagoon > 100 ppt

- Organisms which can tolerate narrow range of salt concentration are referred as Stenohaline.
- Organisms which can tolerate wide range of salt concentration are referred as Euryhaline.

Topography:

• In includes the physical features of the earth like **altitude**, slope, **exposure**, **mountain chains**, **valleys**, **plants**. It affects distribution of organism by influencing the climatic factor like light, wind, rainfall etc.

Nutrient Cycling / Biogeochemical Cycle

| Bio – | Living | organism |
|-------|--------|----------|
|-------|--------|----------|

Geo – Rock, Soil, Water

Chemical - Material or Nutrients

- All the types of material required by ecosystem in addition of energy, are available continuously to ecosystem through recycling. Thus there is a constant exchange of materials between the living organism and their abiotic environment through the recycling of materials. This phenomenon is called Biogeochemical cycle.
- The mineral elements taken up from the environment (soil as well as air) by the green plant, (the producers), are again returned to the environment through consumers and decomposers.
- The following types of cycles are found in an ecosystem
- Gaseous Cycle -C, H, N, O cycles. Reservoir is in the atmosphere (air) or in Hydrosphere(water).
- Sedimentary cycle -P, S, cycles reservoirs are in earth's crust (lithosphere)
- In these cycles, the bulk material remains in the inactive reservoir on earth crust like sediment of sea or water bodies.



Carbon Cycle

- 71% percent of carbon dissolved in ocean
- The main source of carbon is atmosphere and in hydrosphere it is rocks of carbonates. Carbon present in lithosphere in the form of coal and petroleum.

The carbon released from them is present in the atmosphere in the form of carbon dioxide. The green autotrophs utilize CO_2 from the air to synthesize food materials which is obtained by other organisms as food. Carnivores obtain their organic food from the herbivores. These carbonic matter produce CO_2 through the oxidation or respiration which dissolve in air or water and again utilized by the plants.



Annually about 4×10^{13} kg carbon is fixed in biosphere through photosynthesis in biosphere.

Phosphorus Cycle

- Phosphorus is the main constituent of protoplasm, plasma membrane, bones and teeth. Main source of phosphorus is **rocks.** If comes from the weathering of phosphorus containing rock in the soil. Plants absorb this phosphorus from the soil and transfer this phosphate to animals and after the death of animals it is released again into the lithosphere by the action of decomposers.
- **Sometime** some of the elements like phosphorus and calcium reach into the sea through water, from where they transform into rocks. They separate from the cycle for a long time so it is also known as **sedimentary cycle.**
- But when these rocks break after sometime then this phosphorus is again made available to the sea plant or sea weeds, which pass into fish and sea birds. The excretory materials of birds on the rocks of sea shore is called **Guano** and it is a source of phosphorus.



- Plants absorb phosphate from the soil in the form of orthophosphate (Po_4^{3-})
- Phosphorous cycle differ from nitrogen and carbon cycle in atmospheric input of phosphorous through rainfall is much smaller and gaseous exchange of phosphorous between organism and environment is negligible, which both are considerable in Nitrogen and Carbon cycle.

Ecosystem Services

Healthy ecosystems are the base for a wide range of economic, environmental and aesthetic goods and services. The products of ecosystem processes are named as ecosystem services, for example, healthy forest ecosystems purify air and water, mitigate droughts and floods, cycle nutrients, generate fertile oils, **provide** wildlife habitat, maintain biodiversity, pollinate crops, provide storage site for carbon and also provide aesthetic, cultural and spiritual values. Though value of such services of biodiversity is difficult to determine, it seems reasonable to think that biodiversity should carry a hefty price tag. Robert Constanza and his colleagues have very recently tried to put price tags on nature's life-support services. Researchers have put an average price tag of US \$ 33 trillion a year on these fundamental ecosystem's services, which are largely taken for granted because they are free. This is nearly twice the value of the global gross national product GNP which is (US \$ 18 trillion). Out of the total cost of various ecosystem services, the soil formation accounts for about 50 per cent, and contributions of other services like recreation and nutrient cycling, are less than 10 per cent each. The cost of climate regulation and habitat for wildlife are about 6 per cent each.

Biomes

Climatic Zones:

- On the basis of variation in mean temperature along latitude, the mean climatic regions are-(i)Tropical (0º - 20º latitude)
 (ii) Subtropical (20º - 40º latitude)
 (iii) Temperate (40º - 60º latitude)
 (iv) Arctic and Antarctic (60º - 80º latitude)
- The mean temperature declines as we move from tropical to arctic region. A similar climatic zonation occurs with increasing altitude in the mountains. A mountain located in a tropical region will successively have tropical, subtropical, temperate and alpine zones with increasing altitude.

• Within each temperature-based climatic zone, the annual precipitation (rainfall and/or snowfall) varies considerably. These two factors, **temperature** and **precipitation**, together **determine the vegetation** and **soil type**.

| Altitude an | la Latitude |
|------------------------------|-----------------|
| Altitude | Latitude |
| \downarrow | \downarrow |
| Height above the sea surface | The distance of |

of any place.





- The temperature and light values are maximum at the equator, decreases gradually towards the pole. Effect of altitude and latitude are almost same on temperature.
- The types of vegetation from sea level to measuring altitude are similar to increasing latitude (distance from equator).
- Large ecosystem is called biome, mainly large aquatic and terrestrial ecosystem are called biomes. Altitude and latitude determine the boundary of biome.





- Types of World Biomes: From the poles towards the equators.
 - (i) Tundra Biome: 60-80ºN latitude.
 - (ii) Northern Coniferous Forest or Needle Leaf Forest: 40-60°N latitude (Taiga or North wood)
 - (iii) Temperate Deciduous Forest: 40-60°N latitude or Temperate broad leaf forest.
 - (iv) Tropical Rain Forest: 20-40°N latitude.
 - (v) Tropical / Subtropical Deciduous Forest: 20-40°N latitude.
 - (vi) Chaparral (Mediterranean Scrub Forest) Biome
 - (vii) Tropical Savanna Biome
 - (viii) Grassland Biome
 - (ix) Desert Biome
 - Decrease in species at altitudes, from lower to higher altitude on a mountain.
 - **1000 m increase in altitude** results in **temperature drop of about 6.5°C.** This drop in temperature and great seasonal variability at higher altitude are a major factor that reduce biodiversity.
 - The latitudinal and altitudinal gradients of species diversity are two master gradients.
 - Also more complex and heterogenous the physical environment, more complex and diverse will be the flora and fauna.

Latitude and Types of Forest in World and India

• In Northern hemisphere as we moves from equator north world to arctic region consecutive belts of coniferous.

| Tropical rain forest | : | 0 – 20°N |
|---|---|------------|
| Tropical deciduous forest | : | 20 – 40°N |
| Temperate deciduous / Temperate broad leaf forest | : | -40 - 60°N |
| Temperate coniferous/ temperate needle leaf forest or Alpines | : | -50 - 60°N |
| Tundra biome | : | 60°N |



Fig. Different types of vegetation with increasing altitude on mountains (Altitudinal Zonation)

Biosphere:

- All the living and non-living (Biotic + Abiotic) components of the earth (biomes) combine together to constitute a big ecosystem called Biosphere. Biosphere is also called **Ecosphere**.
 - **1. Lithosphere:** The living components and non-living components present on the earth surface constitutes the lithosphere.
 - **2. Hydrosphere:** All living components and non-living components present in water constitutes the hydrosphere.
 - 3. Atmosphere: All living components and non-living components of air constituted the atmosphere.



Note:

- **1.** Biosphere (space ship or earth) is closed system for minerals and biosphere is an open system in regards with the energy.
- **2.** Noo Sphere (noo-mind, Sphere-domain) Because of development of human civilisation biosphere is changed in to human dominating environment called noo sphere.

| | Exerc | cise - I |
|----|--|--|
| | Ecosystem | |
| 1. | Eltonian pyramids of numbers are upright in one of the following ecosystem: (1) Grassland (2) Tree (3) Pond (4) Both (1) and (3) | 8. An aquatic ecosystem consists of: (1) Biotic factors (2) Biotic and abiotic factors (3) Consumers only |
| 2. | The type of food chain in which organic matter decomposed is converted into energy rich compounds is called: (1) Detritus food chain (2) Grazing food chain (3) Cybernetics (4) None above | (4) Producers only 9. The best arrangement of an energy system consisting of hawks, snakes, mice and grasses is: (1) Grass → mice → snake → hawks (2) Grass → snake → mice → hawks (3) Grass → mice → hawks → snakes |
| 3. | One of Eltonian pyramids have to be upright always: (1) Biomass (2) Energy (3) Number (4) All of these | (4) Mice → snake → hawks → grass 10. If a big fish eats small fish which eats Hydra who in turn eats water fleas ; |
| 4. | Word 'ecosystem' was coined by: (1) Elton (2) Tansley (3) Odum (4) Billing | water fleas in turn eat phytoplankton. In this chain, water fleas will be: (1) Producers |
| 5. | Biotic components include: (1) Producers only (2) Consumers only (3) Producers and consumers only (4) Producers, consumers and decomposers | (2) Finnary consumers (3) Secondary consumers (4) Top consumer 11. The graphic representation of trophic level is represented by a pyramid. Which |
| 6. | The last organisms of the food chain are generally: (1) Photosynthetic plants (2) Herbivores (3) Carnivores (4) Top carnivores | of the following pyramid is always a true pyramid unlike the others ? (1) Pyramid of number (2) Pyramid of biomass (3) Pyramid of energy (4) Both (1) and (3) |
| 7. | In an ecosystem, the population of: (1) Primary producers is larger than primary consumers (2) Secondary consumers is largest (3) Primary consumers out numbers primary producers (4) Primary consumers are least dependent upon primary producers | 12. Which of the following constitutes the structure of an ecosystem ? (1) Ecological community (2) Quantity and distribution of abiotic materials (3) Range of physical conditions (4) All the above |

- Ecosystem comprises both abiotic and biotic components. Biotic component of an ecosystem consists of:
 - (1) Producers
 - (2) Consumers
 - (3) Decomposers
 - (4) All the above
- Autotrophic organisms (green plants), which capture solar energy to synthesise organic food are called:
 - (1) Producers
 - (2) Consumers
 - (3) Decomposers
 - (4) None of the above
- **15.** In a pyramid of numbers representing an ecosystem of a large freshwater pond the number of primary consumers is:
 - (1) Less than the Top consumers
 - (2) Less than the secondary consumers
 - (3) Less than the producers
 - (4) Less than the tertiary consumers
- **16.** Food chain refers to:
 - A number of human beings forming a chain for food
 - (2) The transfer of food energy from producers to consumers
 - (3) Animals near a source of food
 - (4) None of the above
- **17.** A group of interconnected food chains is called:
 - (1) Pyramid of energy
 - (2) Food web
 - (3) Food cycle
 - (4) Complex food chain

- **18.** Energy flow in ecosystem is:
 - (1) Unidirectional
 - (2) Bidirectional
 - (3) Multidirectional
 - (4) None of the above
- **19.** The rate at which new tissues are formed in producers is the ecosystem's:
 - (1) Net primary productivity
 - (2) Gross primary productivity
 - (3) Net secondary productivity
 - (4) Gross secondary productivity
- **20.** The importance of ecosystem maintenance lies in:
 - (1) Cycling of materials
 - (2) Flow of energy
 - (3) Both of the above
 - (4) None of these
- **21.** The amount of energy, utilized by herbivores from the plants is:
 - (1) 5% (2) 10%
 - (3) 50% (4) 90%
- **22.** The flow of materials and energy in an ecosystem is respectively:
 - (1) Cyclic only
 - (2) Linear only
 - (3) Linear and cyclic
 - (4) Cyclic and linear
- **23.** Mark the incorrect statement with reference to carbon cycle:
 - (1) Lime rocks contribute to CO_2 of water
 - (2) Atmospheric CO₂ gets dissolved in water
 - (3) CO_2 is returned by combustion of fuel
 - (4) 75% of total carbon lies in geological component

24. Major reservoir of carbon in biosphere lies in:

| (1) Atmosphere | (2) Lithosphere |
|-----------------|------------------|
| (3) Hydrosphere | (4) All of these |

- **25.** Biogeochemical cycling means:
 - (1) Cycling of nutrients in an ecosystem
 - (2) Cycling of water
 - (3) Cycling of energy in an ecosystem
 - (4) Cycling of gases between plants and the atmosphere
- **26.** The least productive ecosystem is:
 - (1) Coastal seas
 - (2) Very deep lakes
 - (3) Grasslands
 - (4) Moist forests
- **27.** One of the following is sedimentary cycle ?
 - (1) Carbon (2) Hydrogen
 - (3) Nitrogen (4) Phosphorus
- **28.** The primary consumers in a pond ecosystem are:
 - (1) Phytoplanktons (2) Zooplanktons
 - (3) Fishes (4) Bacteria
- **29.** The correct sequence of components through which energy may pass from initial source, through an ecosystem is:
 - (1) Sun autotrophs-heterotrophs- space environment
 - (2) Space environment heterotrophs autotrophs sun
 - (3) Sun space environment
 - heterotrophs autotrophs
 - (4) Sun space environment autotrophs– heterotrophs
- **30.** The major reservoir of phosphorous cycle is:
 - (1) Ocean (2) Rocks
 - (3) Atmosphere (4) Pollution

- **31.** Efficiency of any ecosystem is best depicted by pyramid of:
 - (1) Energy (2) Number

(3) Biomass (4) Volume

- When frog eats grasshopper which thrives on green plants, the frog is ?
 (1) Primary producer (2) Herbivore
 (3) Primary carnivore (4) Top consumer
- **33.** The largest ecosystem in the world is contributed by:
 - (1) Forests (2) Rivers
 - (3) Oceans (4) Grasslands
- **34.** They can be put in the category of primary consumers:
 - (1) Eagles and tigers
 - (2) Fishes and whales
 - (3) Snakes and frogs
 - (4) Insects and cattles
- **35.** The word standing crop in ecosystem refers to:
 - (1) Living components
 - (2) Non-living components
 - (3) Both living and non-living components
 - (4) None of the above
- **36.** The pyramid of energy in any ecosystem is:
 - (1) Always upright
 - (2) May be upright
 - (3) Always inverted
 - (4) None of the above
- **37.** One of the following is a true microecosystem
 - (1) One litre of water from a pond kept in an air tight flask
 - (2) One litre of tap water in a flask covered over by cotton plug
 - (3) Ten litre of boiled pond water covered over by a lid
 - (4) One litre of pond water closed with a cork having gas exchange tube.

38. The ecosystem of earth is known as:

| (1) | Biome | (2) Community |
|-------|---------|---------------|
| · · / | DIGINIO | |

(3) Biosphere (4) Association

- **39.** The ecosystem exists in a state of 'balance'. Supposing one of the heterotrophs, says the rabbit, multiplies and increases in number suddenly then:
 - The balance will be permanently upset because the rabbits will eat the grass in the system and die of starvation.
 - (2) The 'balance' will be restored by an increase in the wolf population
 - (3) Epidemics will break out in the rabbits and kill all of them
 - (4) Rabbits will starts eating each other
- **40.** Which of the following is not characteristic of a ecosystem ?
 - (1) Nutrient cycling (2) Energy flow
 - (3) Dominant species (4) Decomposition
- **41.** The amount of living matter present in a component population of a particular trophic level is called as:
 - (1) Standing crop (2) Standing quality
 - (3) Both of these (4) Standing state
- **42.** The term reducer is applied to:
 - (1) Decomposers (2) Detrivores
 - (3) Both of these (4) Heterotrophs
- **43.** The gross production minus respiration losses by plants in an ecosystem is indicated as:
 - (1) Net production
 - (2) Secondary production
 - (3) Net storage
 - (4) Net primary production
- **44.** The biotic and abiotic components of the ecosystem are connected through:
 - (1) Standing quality
 - (2) Climatic regime
 - (3) Transducers
 - (4) Humification and mineralization

- **45.** The rate of storage at consumer level is:
 - (1) Secondary productivity
 - (2) Tertiary productivity
 - (3) Both of these
 - (4) Net productivity
- **46.** The CO₂ is returned to the atmosphere by:
 - (1) Metabolism of producers
 - (2) Metabolism of consumers
 - (3) Combustion of fuel
 - (4) All of these
- **47.** A group of interacting living things and all the environmental factors with which they interact are together called:
 - (1) Ecosystem (2) Succession
 - (3) Producers (4) Ecological niche
- **48.** An ecosystem does not normally alter because it is in a state of:
 - (1) Deficient light
 - (2) Imbalance
 - (3) Homeostasis
 - (4) Deficient components
- **49.** The immediate surroundings of an organism are called:
 - (1) Macroenvironment
 - (2) Microenvironment/microclimate
 - (3) Biosphere
 - (4) Both (1) and (2)
- **50.** Raymond Lindmann (1942) used the term trophic level. Trophic levels are formed by:
 - (1) Animals only
 - (2) Plants only
 - (3) Organisms linked in food chains
 - (4) Top consumers in food chain
- **51.** Organisms which acquire energy and nutrients by digesting the organic molecules of living organisms are called:
 - (1) Producers
 - (2) Consumers
 - (3) Detritivores
 - (4) None of the above

- **52.** Which of the following is the trophic level of man in an ecosystem ?
 - (1) Omnivore (2) Carnivore
 - (3) Herbivore (4) Producer
- **53.** Net community productivity (NCP) is the:
 - (1) Total rate of photosynthesis
 - (2) Chemical energy left after utilization by plants
 - (3) Rate of storage of organic matter by community
 - (4) Energy wasted by carnivores
- **54.** A food chain consists of:
 - (1) Producers, carnivores and decomposers
 - (2) Producers, herbivores and carnivores
 - (3) Producers and primary consumers
 - (4) Producers, consumers and decomposers
- **55.** The animals that feed directly on producers are called:
 - (1) Primary consumers
 - (2) Secondary consumers
 - (3) Tertiary consumers
 - (4) Quaternary consumers
- **56.** Within the ecosystem, energy is transferred from organism to organism in the form of:
 - (1) Light
 - (2) Heat
 - (3) Chemicals
 - (4) None of the above
- **57.** The rate at which light energy is converted to chemical energy of organic molecules is the ecosystem's:
 - (1) Net primary productivity
 - (2) Net secondary productivity
 - (3) Gross primary productivity
 - (4) Gross secondary productivity

- **58.** Producers in an ecosystem are:
 - (1) Green organisms which fix solar energy by photosynthesis
 - (2) Animals which cause an increase in biomass
 - (3) Organisms which can be used as manure
 - (4) Animals in the food chain which produce more energy than they consume
- **59.** The dominant second trophic level in a lake ecosystem is:
 - (1) Phytoplankton (2) Zooplankton
 - (3) Benthos (4) Nekton
- **60.** Pyramid of numbers is upright in which of the ecosystems ?
 - (1) Pond ecosystem
 - (2) Tree ecosystem
 - (3) Grassland ecosystem
 - (4) Both (1) and (3)
- **61.** The total amount of living material at various levels of a food chain is depicted by:
 - (1) Pyramid of numbers
 - (2) Pyramid of energy
 - (3) Pyramid of biomass
 - (4) All the above
- **62.** Zooplankton includes:
 - (1) Ciliates (2) Flagellates
 - (3) Small crustaceans (4) All the above
- **63.** Energy and nutrients enter in a community by way of the:
 - (1) Detritivores (2) Producers
 - (3) Scavengers (4) Consumers
- **64.** Food webs are 3-D web of interrelations in which several food chains are interlinked. It helps to provide:
 - (1) Alternate pathways for flow of energy
 - (2) More variety and quality of food at each trophic level
 - (3) Stability to ecosystem
 - (4) All of these

- **65.** A ecological pyramid, devised by C. Elton 1927; is a graphic diagram that shows relationship between:
 - (1) Transfer of food through food chains
 - (2) Organisms
 - (3) Various trophic levels of a food chain
 - (4) Populations and communities within an ecosystem
- **66.** Ruthless exploitation and pollution of the environment has increased the magnitude of waste materials which has disturbed the operations of all important:
 - (1) Biomes
 - (2) Ecosystems
 - (3) Bio-geo-chemical cycles
 - (4) All of the above
- **67.** Which of the following contribute to the carbon cycle ?
 - (1) Photosynthesis
 - (2) Respiration
 - (3) Fossil fuel combustion
 - (4) All of the above
- **68.** The organisms which participate most actively in nitrogen cycle in nature are:
 - (1) Saprophytic angiosperms
 - (2) Parasitic fungi
 - (3) Bacteria
 - (4) Legumes
- **69.** Biogeochemical cycles can be traced in:

| (1) Ecosystems | (2) Biomes |
|----------------|----------------------|
| (3) Only water | (4) Both (1) and (2) |

70. The phosphorus cycle differs from those of carbon and nitrogen as well as those of oxygen and hydrogen cycle in that it lacks:

| (1) Water | (2) Dust particles |
|-------------------|--------------------|
| (3) Gaseous phase | (4) All above |

- **71.** Cycling of elements in any ecosystem is called:
 - (1) Chemical cycle
 - (2) Geochemical cycle
 - (3) Biogeochemical cycle
 - (4) Geological cycle

- **72.** In India, coniferous forests are found in:
 - (1) Rajasthan
 - (2) Satpura Hills
 - (3) Himalayan region
 - (4) Madhya Pradesh
- **73.** The term biosphere is used for the zone of the earth where life exists:
 - (1) On the lithosphere
 - (2) In the hydrosphere
 - (3) In the lithosphere and hydrosphere
 - (4) In the lithosphere, hydrosphere and atmosphere
- 74. In an ecosystem:
 - (1) Primary producers are more than primary consumers
 - (2) Primary consumers larger than primary producers
 - (3) Secondary consumers are larger than primary producers
 - (4) Primary consumers are least depend on primary producers
- **75.** Ecosystem term coined by:
 - (1) Odum (2) Mishra
 - (3) Reiter (4) Tensley
- **76.** Savannahs are:
 - (1) Tropical rain forest
 - (2) Desert
 - (3) Grassland with scattered trees
 - (4) Dense forest with close canopy
- **77.** The maximum energy is stored at following tropical level in any ecosystem:
 - (1) Producers
 - (2) Herbivores
 - (3) Carnivores
 - (4) Top carnivores

78. The source of energy in an ecosystem is:

- (1) Sunlight (2) DNA
 - (3) ATP (4) RNA
- **79.** Largest ecosystem of the world are:
 - (1) Forests (2) Grass lands
 - (3) Great lakes (4) Oceans

- **80.** Green plants in a forest ecosystem are:
 - (1) Suppliers of food & O_2
 - (2) Consumers of nutritive materials
 - (3) Consumers of animal proteins
 - (4) Suppliers of timber
- 81. A pond is a:
 - (1) Biome
 - (2) Natural ecosystem
 - (3) Artificial ecosystem
 - (4) Landscape
- 82. Nepenthes (Insectivorous pitcher plant) is:
 - (1) Producer (2) Consumer
 - (3) Both 1 & 2 (4) None of these
- **83.** Which biotic components mainly help in recycling of minerals ?
 - (1) Producers (2) Consumers
 - (3) Decomposers (4) All the above
- **84.** Trophic levels are formed by:
 - (1) Only plants
 - (2) Only carnivores
 - (3) Only animals
 - (4) Organisms linked in food chain
- **85.** In an ecosystem the function of the producers is to:
 - (1) Convert organic compounds into inorganic compounds
 - (2) Trap solar energy and convert it into chemical energy
 - (3) Utilize chemical energy
 - (4) Release energy
- **86.** When peacock, eats snake which eats insects depends on green plants, the peacock is ?
 - (1) A primary consumer
 - (2) A primary decomposer
 - (3) A final decomposer of plants
 - (4) The apex of the food pyramid

- **87.** Path of energy flow in a n ecosystem is:
 - (1) Herbivorous \rightarrow producer \rightarrow carnivorous \rightarrow decomposer
 - (2) Herbivorous \rightarrow carnivorous \rightarrow producer \rightarrow decomposer
 - (3) Producer \rightarrow carnivorous \rightarrow herbivorous \rightarrow decomposer
 - (4) Producer \rightarrow herbivorous \rightarrow carnivorous \rightarrow decomposer
- **88.** Science of self control in an ecosystem is called:
 - (1) Synecology (2) Autecology
 - (3) Cybernetics (4) Edaphology
- **89.** An ecosystem resists change because it is in a state of:
 - (1) Homeorhesis
 - (2) Regular Illumination
 - (3) Static Imbalance
 - (4) Food accumulation
- 90. What is true about any ecosystem ?
 - (1) It is self regulatory
 - (2) It is self sustained
 - (3) Top carnivores have climax tropic level position
 - (4) All
- **91.** The storage of energy of consumer level is known as:
 - (1) Grass primary production
 - (2) Secondary productivity
 - (3) Net primary productivity
 - (4) Net productivity
- **92.** Gross primary productivity is:
 - (1) Rate at which organic molecules are formed in an autotroph
 - (2) Rate at which organic molecules are used up by an autotroph
 - (3) Storage of organic molecules in the body of an autotroph
 - (4) Rate at which organic molecules are transferred to next higher trophic level

- **93.** Carbon cycle includes (the following is a logical sequence):
 - (1) Producer consumer decomposer
 - (2) Decomposer consumer producer
 - (3) Producer decomposer consumer
 - (4) Consumer producer decomposer
- **94.** The flow of materials from non living components to living components and back to the non living components in a more or less cyclic manner is called a:
 - (1) Gaseous cycle
 - (2) Sedimentary cycle
 - (3) Biogeochemical cycle
 - (4) Hydrologic cycle
- **95.** All the living organisms and non-living factors of the earth constitute:
 - (1) Biosphere
 - (2) Community
 - (3) Biome
 - (4) Association
- 96. Which biome refers to arctic desert ?
 - (1) Tundra (2) Taiga
 - (3) Savannah (4) Thar desert
- **97.** Which biome is most rich in fauna and flora ?
 - (1) Deciduous forests
 - (2) Chaparral
 - (3) Tropical rain forests
 - (4) Taiga
- **98.** Autumn colouration of leaves appear only in:
 - (1) Tropical regions
 - (2) Evergreen plants
 - (3) Temperate deciduous plants
 - (4) deserts

- **99.** What ecological factors are most strong determinants of various biomes:
 - (1) Soil and wind
 - (2) Light and wind
 - (3) Temperature and precipitation
 - (4) pH and humidity
- **100.** Which of the following is direct dominant ecological factor which affects the vegetation of a place ?
 - (1) Temperature (2) Altitude
 - (3) Soil (4) Wind
- **101.** Which of the following is a physiological adaptation to cope with certain stressful environment ?
 - (1) CAM pathway
 - (2) Lizard basking in sun
 - (3) Leaves modified into spines
 - (4) Thick cuticle
- **102.** The Biological weathering occurs due to the action of:
 - (1) Carbon dioxide (2) Oxygen
 - (3) Alkalies (4) Acids
- **103.** In general environmental condition which of the following represents partial regulators ?



- **104.** Which of the following factors cannot be regarded as belonging to a non living environment ?
 - (1) Rainfall
 - (2) Light
 - (3) Temperature
 - (4) Interspecific competition

- **105.** Factors which relate to form and behaviour of the earth's surface are called:
 - (1) Biotic (2) Edaphic
 - (3) Topographic (4) Climatic
- **106.** In the given factor vegetation of any place is primarily determined by:
 - (1) Rainfall
 - (2) Amount of soil water
 - (3) Soil type
 - (4) Amount of light
- **107.** A soil is said to be fertile when:
 - (1) It is rich in organic matter
 - (2) It has capacity to hold water
 - (3) It has a capacity to hold nutrients
 - (4) It holds water & all essential nutrients in a definite proportion

- **108.** The science dealing with soil is called:
 - (1) Edophology (2) Acarology
 - (3) Geology (4) Palaeantology
- **109.** The periodic departure and return is known as:
 - (1) Migration
 - (2) Immigration
 - (3) Emigration
 - (4) Mutation
- **110.** Scavengers are:
 - (1) Carnivores
 - (2) Predators
 - (3) Decomposers
 - (4) All of the above

| | ANSWER KEY | | | | | | | | | | | | | | | | | | | | | | | | |
|------|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|
| Que. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |
| Ans. | 4 | 1 | 2 | 2 | 4 | 4 | 1 | 2 | 1 | 2 | 3 | 4 | 4 | 1 | 3 | 2 | 2 | 1 | 1 | 3 | 2 | 4 | 4 | 3 | 1 |
| Que. | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
| Ans. | 2 | 4 | 2 | 4 | 2 | 1 | 3 | 3 | 4 | 1 | 1 | 4 | 3 | 2 | 3 | 1 | 3 | 4 | 3 | 1 | 4 | 1 | 3 | 2 | 3 |
| Que. | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 |
| Ans. | 2 | 1 | 3 | 2 | 1 | 3 | 3 | 1 | 2 | 4 | 3 | 4 | 2 | 4 | 3 | 4 | 4 | 3 | 4 | 3 | 3 | 3 | 1 | 1 | 4 |
| Que. | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |
| Ans. | 4 | 1 | 1 | 4 | 1 | 2 | 3 | 3 | 4 | 2 | 4 | 4 | 3 | 1 | 4 | 2 | 1 | 1 | 3 | 2 | 1 | 3 | 3 | 3 | 1 |
| Que. | 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 | | | | | | | | | | | | | | | |
| Ans. | 1 | 4 | 3 | 4 | 3 | 1 | 4 | 1 | 1 | 1 | | | | | | | | | | | | | | | |

| | | Exerc | ise - II | | | | | | | | |
|----------|--|---|------------|--|--|--|--|--|--|--|--|
| 1. 2. | Pyramid of number i (1) Grassland (3) Ocean Gaseous phase is abs | s upright in: (2) Pond (4) All sent in which cycle ? | 8. | Evergreen forest with (1) Tropical forests (2) Temperate forest (3) Coniferous forest (4) None of these | n needle leaves are: :s :s | | | | | | |
| 3. | (1) Carbon cycle (2) Water cycle (3) Nitrogen cycle (4) Phosphorous cyc The pyramid of e | le nergy in a forest | 9. | Which food chain is most common in terrestrial ecosystem ? (1) DFC (2) GFC (3) Parasitic food chain (4) None of these | | | | | | | |
| | ecosystem is - (1) Always upright (2) Always inverted (3) Both upright and (4) None of the aboy | inverted ve | 10. | (4) None of these Sal and teak are fou (1) Tropical rain fores (2) Tropical deciduou (3) Temperature boa (4) Temperature nee | nd in - st us forest rd leaf forest dle leaf forest | | | | | | |
| 4. | More complex food (1) High diversity in e (2) High stability in e (3) High food variety (4) All of the above | web shows: ecosystem ecosystem in ecosystem | 11. 12. | During food chain th is stored in - (1) Producers (3) Herbivores In the phosphorus | e maximum energy (2) Decomposers (4) Carnivores cycle, weathering | | | | | | |
| 5. | Nepenthes is a - (1) Primary producer (2) Consumer (3) Both primary prod (4) None of the abov | ucer and consumer re | 13. | makes phosphate available first to - (1) Decomposers (2) Consumers (3) Producers (4) All the above In a food chain, the total amount of living material is depicted by - (1) Pyramid of biomass (2) Pyramid of energy (3) Pyramid of number (4) Trophic levels Nitrates are converted to nitrogen by - (1) Nitraten fixing bacteria | | | | | | | |
| 6. | The two components (1) Biotic and abiotic (2) Plants and anima (3) Weeds and micro | of an ecosystem are - Ils o-organism | 14. | | | | | | | | |
| 7. | The pyramid of nur ecosystem is - (1) Linear | nber in a grassland (2) Upright | 15. | (2) Ammonification b(3) Denitrifying bacter(4) Nitrifying bacteriaPyramids of biomass in | oacteria eria a n pond ecosystem is - | | | | | | |
| | (3) Irregular | (4) Inverted | | (1) Inverted (3) Linear | (2) Upright (4) Irregular | | | | | | |

- 16. Lion is kept under in Eltonian pyramid as -
 - (1) Producer
 - (2) Primary consumer
 - (3) Secondary consumer
 - (4) Tertiary consumer
- **17.** Bacteria and fungi developing on dead decaying organisms are -
 - (1) Parasites (2) Commensals
 - (3) Saprophytes (4) Symbionts
- **18.** Phytoplanktons are important biotic component of -
 - (1) Grassland (2) Pond ecosystem
 - (3) Forest ecosystem (4) None of these
- **19.** Which ecological pyramid can never occur in an inverted form ?
 - (1) Pyramid of number
 - (2) Pyramid of biomass
 - (3) Pyramid of energy
 - (4) Pyramid of species richess
- **20.** Peacock eats a snake and snake eats insect while insect eats green plant, then position of peacock is -
 - (1) Primary producer
 - (2) Secondary producer
 - (3) Decomposer
 - (4) Top at the apex of food pyramid
- 21. Source of energy in an ecosystem is -
 - (1) Sun
 - (2) ATP
 - (3) Sugar made by plant
 - (4) Green plant
- 22. Energy enters in food chain -
 - (1) By transducers
 - (2) By primary consumers
 - (3) By secondary consumers
 - (4) By tertiary consumers

- **23.** The importance of ecosystem lies in -
 - (1) Energy flow
 - (2) Cycling of materials
 - (3) Both
 - (4) None
- **24.** Concept of Ecological pyramid was given by -
 - (1) Odum
 - (2) Elton
 - (3) Darwin
 - (4) Reiter
- 25. Driving force of ecosystem is -
 - (1) Producers
 - (2) Plants with Carbohydrate
 - (3) Biomass
 - (4) Solar energy
- 26. Ecosystem creates -
 - (1) Food chain (2) Food web
 - (3) Food (4) None
- 27. Biosphere refers to -
 - (1) Plants of the world
 - (2) Special plants
 - (3) Area occupied by living beings
 - (4) Plants of a particular area
- 28. Mr. X is eating curd/yoghurt. For this food intake in a food chain he should be considered as occupying -
 - (1) First trophic level
 - (2) Second trophic level
 - (3) Third tropic level
 - (4) Fourth trophic level
- **29.** The Great Barrier Reef along the east coast of Australia can be categorized as -
 - (1) Population (2) Community
 - (3) Ecosystem (4) Biome

30. Given below is one of the types of ecological pyramids. This type represents -



- (1) Pyramid of numbers in a grassland
- (2) Pyramid of biomass in a fallow land
- (3) Pyramid of biomass in a lake
- (4) Energy pyramid in a spring
- **31.** Which one of the following is correct matching of a plant, its habit and the forest type where it normally occurs ?
 - (1) **Prosopis**, tree, scrub
 - (2) **Saccharum**, grass, forest
 - (3) Shorea robusta, herb, tropical rain forest
 - (4) *Acacia catechu*, tree, coniferous forest
- 32. Acacia, Prosopis and Caparis belongs to (1) Deciduous forest (2) Tropical forest
 (3) Thorn forest (4) Evergreen forest
- **33.** Total amount of energy trapped by green plants in food is called -
 - (1) Gross primary production
 - (2) Net primary production
 - (3) Standing crop
 - (4) Standing state
- **34.** Bacteria are essential in carbon cycle as -
 - (1) Decomposer (2) Synthesizer
 - (3) Consumer (4) Pri. Producer
- **35.** Percentage energy transferred to higher trophic level in food chain is -
 - (1) 1 % (2) 10 %
 - (3) 90 % (4) 100 %
- **36.** Which of the following is a correct pair -
 - (1) Cuscuta parasite
 - (2) Orchid insectivorous
 - (3) Opuntia predator
 - (4) Capsella hydrophyte

- 37. Bamboo plant is growing in a far forest then what will be the tropic level of it (1) First trophic level (T₁)
 - (2) Second trophic level (T_2)
 - (3) Third trophic level (T_3)
 - (4) Fourth trophic level (T_4)
- **38.** Which of the following is expected to have the highest value (gm/m²/yr) in a grassland ecosystem ?
 - (1) Tertiary production
 - (2) Gross production (GP)
 - (3) Net production (NP)
 - (4) Secondary production
- 39. An ecosystem which can be easily damaged but can recover after some time if damaging effect stops will having
 (1) High stability and low resilience
 (2) Low stability and low resilience
 (3) High stability and high resilience
 - (4) Low stability and high resilience
- **40.** Which one of the following pairs is mismatched -
 - (1) Savanna Acacia trees
 - (2) Coniferous forest evergreen trees
 - (3) Tundra permafrost
 - (4) Prairies epiphytes
- 41. Humus is:(1) Dead and decayed organic matter(2) Living matter
 - (3) Fertilizers
 - (4) Living animal / plants / microbes
- **42.** Suspension of developmental stage is termed as:
 - (1) Hibernation (2) Aestivation
 - (3) Diapause (4) Regulation
- **43.** Which of the following have sunken stomata ?
 - (1) Nerium
 - (2) Mangifera
 - (3) Hydrilla
 - (4) Zea mays

- **44.** Which soil is considered as most suitable for plant growth ?
 - (1) Sandy soil
 - (2) Loamy soil
 - (3) Clayey soil
 - (4) None of the above
- **45.** What is the best pH of the soil for cultivation of plants ?
 - (1) 3.4 5.4 (2) 6.5 7.5
 - (3) 4.5 8.5 (4) 5.5 6.5
- **46.** Forests near equator region are called:
 - (1) Deciduous
 - (2) Tropical rain forests
 - (3) Coniferous forests
 - (4) Temperate forests
- **47.** Insectivorous plants grow in the soil which is deficient in:
 - (1) Mg (2) Ca (3) P (4) N
- **48.** Organisms having narrow range of tolerance for temperature show:
 - (1) Wide distribution
 - (2) Limited distribution
 - (3) No effect of temperature on distribution
 - (4) Distribution only in deserts
- **49.** In which one of the following habitats does the diurnal temperature of soil surface vary most ?
 - (1) Forest (2) Desert

(4) Shrub land

(3) Grassland

50. Photosynthetically active radiation (PAR) represents the following range of way length:

| (1) 400 – 700 nm | (2) 500 – 600 |
|------------------|------------------|
| (3) 450 – 950 | (4) 340 – 450 nm |

- **51.** Delay in development due to unfavourable environmental conditions is called:
 - (1) Hibernation
 - (2) Aestivation
 - (3) Diapause
 - (4) All of the above
- **52.** Insectivorous plants usually survive in:
 - (1) Water rich soil
 - (2) N₂ deficient soil
 - (3) N₂ rich soil
 - (4) Sugar deficient medium
- **53.** Match the list-I with list-II and select correct answer:

| | | L | ist-l | | List-II | | | | |
|-----|---|---|---|---|---|---|--|--|--|
| (A) | See | ds ai | nd Birds | (i) | Ammensalism | | | | |
| (B) | Сор | ерос | ls and Fi | (ii) | Commensalism | | | | |
| (C) | Part Oth | henii er pla | um and ants | (iii) | Predation | | | | |
| (D) | Brai | nacle | s on wha | (iv) | Parasitism | | | | |
| | | A | В | С | | D | | | |
| (1) |) | II | 111 | Ι | | IV | | | |
| (2 |) | II | IV | Ι | | 111 | | | |
| (3) | | | IV | I | | II | | | |
| (4) | | | I | IV | | II | | | |
| | (A) (B) (C) (D) (1) (2 (3) (4) | (A) See (B) Cop (C) Part Oth (D) Brand (1) (2) (3) (4) | (A) Seeds and the service of the s | List-I (A) Seads and Birds (B) Colspan="2">Colspan="2">Colspan="2" (C) Parthenium and Otter plants (D) B (I) III III (1) II III III (2) II IV IV (3) III IV (4) III I | List-I(A)Seeds and Birds(B) $C \rightarrow colspace(C)Parthenium andOther plants(D)Brancles on whale(1)II(2)II(3)III(4)III$ | List-I (i) (A) Seeds and Birds (i) (B) Colspan="4">(ii) (C) Parthenium and Other plants (iii) (D) Branacles on whale C (i) (1) II III I (2) II IV I (3) III IV I (4) III I IV I | | | |

| | ANSWER KEY | | | | | | | | | | | | | | | | | | | | | | | | |
|------|------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Que. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |
| Ans. | 4 | 4 | 1 | 4 | 3 | 1 | 2 | 3 | 1 | 2 | 1 | 3 | 1 | 3 | 1 | 4 | 3 | 2 | 3 | 4 | 1 | 1 | 3 | 2 | 4 |
| Que. | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
| Ans. | 2 | 3 | 3 | 3 | 3 | 1 | 3 | 1 | 1 | 2 | 1 | 1 | 2 | 4 | 4 | 1 | 3 | 1 | 2 | 4 | 2 | 4 | 2 | 2 | 1 |
| Que. | 51 | 52 | 53 | | | | | | | | | | | | | | | | | | | | | | |
| Ans. | 3 | 2 | 3 | | | | | | | | | | | | | | | | | | | | | | |

Exercise – III (Previous Year Questions)

[AIPMT-2003]

- The slow rate of decomposition of fallen logs in nature is due to their -
 - (1) Anaerobic environment around them
 - (2) Low cellulose content
 - (3) Low moisture content
 - (4) Poor nitrogen content

[AIPMT 2005]

- **2.** Which one of the following is *not* used for construction of ecological pyramids ?
 - (1) Rate of energy flow
 - (2) Fresh weight
 - (3) Dry weight
 - (4) Number of individuals

[AIPMT 2006]

- **3.** Annual migration does *not* occur in the case of:
 - (1) Salamander
 - (2) Arctic tern
 - (3) Salmon
 - (4) Siberian crane

[AIPMT 2007]

- **4.** Which one of the following ecosystem types has the highest annual net primary productivity-
 - (1) Temperate deciduous forest
 - (2) Tropical rain forest
 - (3) Tropical deciduous forest
 - (4) Temperate evergreen forest

[AIPMT-2008]

- 5. Quercus species are the dominant component in -
 - (1) Scrub forests
 - (2) Tropical rain forests
 - (3) Temperature deciduous forests
 - (4) Alpine forests

- Consider the following statements concerning food chain -
 - (a) Removal of 80 % tigers from an area resulted in greatly increased growth of vegetation
 - (b) Removal of most of the carnivores resulted in an increased population of deers
 - (c) The length of food chains is generally limited to 3-4 trophic levels due to energy loss
 - (d) The length of food chains may very from 2 to 8 trophic levels

Which two of the above statements are correct ?

| (1) a, c | (2) a, b |
|----------|----------|
| (3) b, c | (4) c, d |

- About 70 % of total global carbon is found in -
 - (1) Ocean
 - (2) Forests
 - (3) Desert
 - (4) Rain forest

[AIPMT 2009]

- Reduction in vascular tissue, mechanical tissue and cuticle in characteristic of:
 - (1) Hydrophytes
 - (2) Xerophytes
 - (3) Mesophytes
 - (4) Epiphytes
- **9.** Which one of the following types of organisms occupy more than one trophic level in a pond ecosystem ?
 - (1) Frog (2) Phytoplankton
 - (3) Fish (4) Zooplankton

[Pre-AIPMT 2010]

10. The given figure below is a diagrammatic representation of response of organisms to abiotic factors. What do a, b and c represent respectively:



| (1) Conformer | Regulator | Partial |
|---------------|-----------|-----------|
| | | regulator |
| (2) Regulator | Partial | Conformer |
| | | regulator |
| (3) Partial | Regulator | Conformer |
| | | regulator |
| (4) Regulator | Conformer | Partial |
| | | Regulator |

- **11.** Study the four statements (1-4) given below and select the two correct once out of them-
 - (A) A lion eating a deer and a sparrow feeding on grain are ecologically similar in being consumers
 - (B) Predator star fish helps in maintaining species diversity of some invertebrates
 - (C) Predators ultimately lead to the extinction of prey species
 - (D) Production of chemicals such as nicotine, strychnine by the plants are metabolic disorders

The two correct statements are:

| (1) A and D | (2) A and B |
|-------------|-------------|
|-------------|-------------|

(3) B and C (4) C and D

- 12. The biomass available for consumption by the herbivores and the decomposers is called-
 - (1) Net primary productivity
 - (2) Secondary productivity
 - (3) Standing crop
 - (4) Gross primary productivity

[Mains-AIPMT 2010]

13. Which of the following representations shows the pyramid of numbers in a forest ecosystem?



[Mains-AIPMT 2011]

14. Consider the following statements

(A)-(D) each with one or two blanks:

- (A) Bears go into ____(1) ___ during winter to ____(2) ___ cold weather.
- (B) A conical age pyramid with a broad base represents ____(3)___ human population.
- (C) A wasp pollinating a fig flower is an example of ___(4)____.
- (D) An area with high levels of species richness is known as ____(5)___.

Which of the following options, gives the correct fill ups for the respective blank numbers from (1) to (5) in the statements ?

- (1) (1) hibernation, (2) escape,
 - (3) expanding, (5) hot spot
- (2) (3) stable, (4) commensalism,(5) marsh
- (3) (1) aestivation, (2) escape,
 - (3) stable, (4) mutualism
- (4) (3) expanding, (4) commensalism,
 - (5) biodiversity park

[Pre-AIPMT 2011]

15. Consider the following four conditions (a – d) and select the correct pair of them as adaptation to environment in desert lizards.

The conditions:

(a) Burrowing in soil to escape high

temperature

- (b) Losing heat rapidly from the body during high temperature
- (c) Bask in sun when temperature is low
- (d) Insulating body due to thick fatty dermis

Options:

- (1) (a), (b) (2) (c), (d)
- (3) (a), (c) (4) (b), (d)
- **16.** Mass of living matter at a trophic level in an area at any time is called:
 - (1) Standing state
 - (2) Standing crop
 - (3) Detritus
 - (4) Humus
- Which one of the following statements for pyramid of energy is incorrect, whereas the remaining three are correct ?
 - (1) It is upright in shape
 - (2) Its base is broad
 - (3) It shows energy content of different trophic level organisms
 - (4) It is inverted in shape
- 18. Which one of the following animals may occupy more than one trophic levels in the same ecosystem at the same time ?
 (1) Frog
 (2) Sparrow
 - (3) Lion (4) Goat
- **19.** The breakdown of detritus into smaller particles by earthworm is a process called:
 - (1) Catabolism
 - (2) Humification
 - (3) Fragmentation
 - (4) Mineralisation

- **20.** Of the total incident solar radiation the proportion of PAR is:
 - (1) More than 80% (2) About 70%
 - (3) About 60% (4) Less than 50%

[RPMT 2011]

- 21. In parasitic food chain, the pyramid of number is(1) Inverted
 - (2) Upright
 - (3) Linear
 - (4) Upright and inverted
- 22. Ten percent law of energy transfer in a food chain is given by(1) Schimper (2) Elton
 - (3) Haeckel (4) Lindemann
- **23.** In a food chain the largest population is that of
 - (1) Producers
 - (2) Decomposers
 - (3) Secondary consumers
 - (4) Primary consumers

[AIPMT Pre-2012]

- **24.** People who have migrated from the planes to an area adjoining Rohtang pass about six months back:
 - (1) Suffer from altitude sickness with symptoms like nausea, fatigue, etc.
 - (2) Have the usual RBC count but their haemoglobin has very high binding affinity to O₂
 - (3) Have more RBCs and their haemoglobin has a lower binding affinity to O₂
 - (4) Are not physically fit to play games like football.
- **25.** Which one of the following is not a functional unit of an ecosystem:-
 - (1) Productivity (2) Stratification
 - (3) Energy flow (4) Decomposition
- **26.** The upright pyramid of number is absent in:-
 - (1) Lake (2) Grassland
 - (3) Pond (4) Forest

- **27.** Which one of the following is not a gaseous biogeochemical cycle in ecosystem?
 - (1) Nitrogen cycle
 - (2) Carbon cycle
 - (3) Sulphur cycle
 - (4) Phosphorus cycle
- **28.** Given below is an imaginary pyramid of numbers. What could be one of the possibilities about certain organisms at some of the different levels?



- Level one PP is "Pipal trees" and the level SC is "sheep"
- (2) Level PC is "rats" and level SC is "cats"
- (3) Level PC is "insects" and level SC is "small" insectivorous birds
- (4) Level PP is "Phytoplanktons" in sea and "Whale" on top level TC.
- **29.** Identify the possible link "A" in the following food chain:

 $Plant \rightarrow Insect \rightarrow Frog \rightarrow "A" \rightarrow Eagle$

- (1) Cobra (2) Parrot
- (3) Rabbit (4) Wolf

[AIPMT Mains-2012]

30. Identify the likely organisms (a), (b), (c) and (d) in the food web shown below:



Option:

| | (a) | (b) | (c) | (d) |
|-----|----------|----------|----------|--------|
| (1) | rat | dog | tortoise | crow |
| (2) | squirrel | cat | rat | pigeon |
| (3) | deer | rabbit | frog | rat |
| (4) | dog | squirrel | bat | deer |

- **31.** The rate of formation of new organic matter by rabbit in a grassland, is called:
 - (1) Net primary productivity
 - (2) Gross primary productivity
 - (3) Net productivity
 - (4) Secondary productivity

[NEET-UG 2013]

- **32.** Secondary productivity is rate of formation of new organic matter by:
 - (1) Decomposer (2) Producer
 - (3) Parasite (4) Consumer
- 33. Which one of the following processes during decomposition is correctly described ?
 - (1) Leaching Water soluble inorganic nutrients rise to the top layers of soil
 - (2) Fragmentation Carried out by organisms such as earthworm
 - (3) Humification Leads to the accumulation of a dark coloured substance humus which undergoes microbial action at a very fast rate
 - (4) Catabolism Last step in the decomposition under fully anaerobic condition.

[AIIMS-2014]

- **34.** Which of the following show inverted pyramid of biomass?
 - (1) Pond ecosystem
 - (2) Tree ecosystem
 - (3) Grass ecosystem
 - (4) Agricultural system

[AIPMT-2014]

- **35.** Just as a person moving from Delhi to Shimla to escape the heat for the duration of hot summer, thousands of migratory birds from Siberia and other extremely cold northern regions move to:
 - (1) Western Ghat
 - (2) Meghalaya
 - (3) Corbett National Park
 - (4) Keolado National Park

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



Option:

| | A | В | С | D | | |
|-----|-------------|-------------|-------------|-------------|--|--|
| (1) | Rock | Dotrituc | Littor fall | Produore | | |
| | minerals | Detitus | Litter Tall | Flouuers | | |
| (2) | Littor fall | Producore | Rock | Detritus | | |
| (2) | LILLEI TALL | FIOUUCEIS | minerals | | | |
| (2) | Dotritue | Rock | Producor | Littor fall | | |
| (3) | Detritus | minerals | FIOUUCEI | Litter fall | | |
| (1) | Producers | Litter fall | Rock | Detritus | | |
| (+) | liouuceis | LILLEI TALL | minerals | Detillus | | |

[AIPMT-2015]

- **37.** The mass of living material at a trophic level at a particular time is called:
 - (1) Standing state
 - (2) Net primary productivity
 - (3) Standing crop
 - (4) Gross primary productivity
- 38. In an ecosystem the rate of production of organic matter during photosynthesis is termed as:
 - (1) Gross primary productivity
 - (2) Secondary productivity
 - (3) Net productivity
 - (4) Net primary productivity
- **39.** Most animals are tree drivellers in a:
 - (1) Thorn woodland
 - (2) Temperate deciduous forest
 - (3) Tropical rain forest
 - (4) Coniferous forest

[Re-AIPMT 2015]

40. In which of the following both pairs have correct combination?

| | Gaseous | Sulphur and | | | | | | | | | |
|-----|----------------|--------------|--|--|--|--|--|--|--|--|--|
| (1) | Nutrient cycle | Phosphorus | | | | | | | | | |
| | Sedimentary | Carbon and | | | | | | | | | |
| | nutrient cycle | Nitrogen | | | | | | | | | |
| | Gaseous | Carbon and | | | | | | | | | |
| (-) | nutrient cycle | Nitrogen | | | | | | | | | |
| (2) | Sedimentary | Sulphur and | | | | | | | | | |
| | nutrient cycle | Phosphorus | | | | | | | | | |
| | Gaseous | Carbon and | | | | | | | | | |
| | nutrient cycle | sulphur | | | | | | | | | |
| (3) | Sedimentary | Nitrogen and | | | | | | | | | |
| | nutrient cycle | Phosphorus | | | | | | | | | |
| | Gaseous | Nitrogen and | | | | | | | | | |
| | nutrient cycle | sulphur | | | | | | | | | |
| (4) | Sedimentary | Carbon and | | | | | | | | | |
| | nutrient cycle | Phosphorus | | | | | | | | | |
| | | | | | | | | | | | |

[Re-AIPMT 2015]

- **41.** The term ecosystem was coined by
 - (1) E.P. Odum (2) A.G. Tansley
 - (3) E. Haeckel (4) E. Warming

[NEET-II 2016]

- **42.** At deep oceanic hydrothermal vents the primary producer are:
 - (1) Green algae
 - (2) Chemoautotrophic bacteria
 - (3) Blue green algae
 - (4) Coral reefs
- **43.** Which one of the following is a characteristic feature of cropland ecosystem?
 - (1) Absence of soil organisms
 - (2) Least genetic diversity
 - (3) Absence of weeds
 - (4) Ecological succession

[NEET-2017]

- **44.** Which ecosystem has the maximum biomass?
 - (1) Forest ecosystem
 - (2) Grassland ecosystem
 - (3) Pond ecosystem
 - (4) Lake ecosystem

[NEET-2018]

- **45.** What type of ecological pyramid would obtained with the following data ? Secondary consumer: 120 g Primary consumer: 60 g Primary producer: 10 g
 - (1) Upright pyramid of biomass
 - (2) Inverted pyramid of biomass
 - (3) Upright pyramid of numbers
 - (4) Pyramid of energy

[NEET-2019]

- **46.** Which of the following ecological pyramids is generally inverted ?
 - (1) Pyramid of biomass in a forest
 - (2) Pyramid of biomass in a sea
 - (3) Pyramid of numbers in grassland
 - (4) Pyramid of energy

[NEET-2020]

- **47.** Match the trophic levels with their correct species examples in grassland ecosystem.
 - (a) Fourth trophic level (i) Crow
 - (b) Second trophic level (ii) Vulture
 - (c) First trophic level (iii) Rabbit
 - (d) Third trophic level (iv) Grass

Select the correct option:

| | (a) | (u) | (\mathcal{C}) | (u) |
|-----|-------|-------|-----------------|------|
| (1) | (i) | (ii) | (iii) | (iv) |
| (2) | (ii) | (iii) | (iv) | (i) |
| (3) | (iii) | (ii) | (i) | (iv) |
| (4) | (iv) | (iii) | (ii) | (i) |

- **48.** In relation to Gross primary productivity and Net primary productivity of an ecosystem, which one of the following statements is correct?
 - (1) There is no relationship between Gross primary productivity and Net productivity
 - (2) Gross primary productivity is always less than net primary productivity
 - (3) Gross primary productivity is always more than net primary productivity.
 - (4) Gross primary productivity and Net primary productivity are one and same.

[NEET-2020 (Covid-19)]

- **49.** Which of the following statements is incorrect?
 - (1) Biomass decreases from first to fourth trophic level
 - (2) Energy content gradually increases from first to fourth trophic level
 - (3) Number of individuals decreases from first trophic fourth trophic level
 - (4) Energy content gradually decreases from first to fourth trophic level
- **50.** Which of the following statements is incorrect regarding the phosphorus cycle?
 - (1) Phosphates are the major form of phosphorus reservoir
 - (2) Phosphorus solubilising bacteria facilitate the release of phosphorus from organic remains
 - (3) There is appreciable respiratory release of phosphorus into atmosphere
 - (4) It is sedimentary cycle
- **51.** The rate of decomposition is faster in the ecosystem due to following factors EXCEPT:
 - (1) Detritus rich in sugars
 - (2) Warm and moist environment
 - (3) Presence of aerobic soil microbes
 - (4) Detritus richer in lignin and chitin
- **52.** According to Alexander von Humboldt:
 - (1) Species richness decreases with increasing area of exploration
 - (2) Species richness increases with increasing area but only up to limit
 - (3) There is no relationship between species richness and area explored.
 - (4) Species richness goes on increasing with increasing area of exploration

[NEET-2021]

- **53.** Which of the following statements is not correct ?
 - (1) Pyramid of biomass in sea is generally inverted.
 - (2) Pyramid of biomass in sea is generally upright.
 - (3) Pyramid of energy is always upright.
 - (4) Pyramid of numbers in a grassland ecosystem is upright.

- **54.** In the equation GPP–R = NPP
 - (1) Radiant energy
 - (2) Retardation factor
 - (3) Environment factor
 - (4) Respiration losses

55. Match List-I with List-II.

| | List-l | | List-II |
|-----|---------------|-------|-------------|
| (a) | Allen's Rule | (i) | Kangaroo |
| | | | rat |
| (b) | Physiological | (ii) | Desert |
| | adaptation | | lizard |
| (c) | Behavioural | (iii) | Marine fish |
| | adaptation | | at depth |
| (d) | Biochemical | (iv) | Polar seal |
| | Adaptation | | |

Choose the correct answer from the options given below.

| | (a) | (b) | (c) | (d) |
|-----|------|-------|-------|-------|
| (1) | (iv) | (ii) | (iii) | (i) |
| (2) | (iv) | (i) | (iii) | (ii) |
| (3) | (iv) | (i) | (ii) | (iii) |
| (4) | (iv) | (iii) | (ii) | (i) |

56. Assertion (A):

A person goes to high altitude and experiences 'altitude sickness' with symptoms like breathing difficulty and heart palpitations.

Reason (R):

Due to low atmospheric pressure at high altitude, the body does not get sufficient oxygen.

In the light of the above statements, choose the correct answer from the options given below.

- Both (A) and (R) are true and (R) is the correct explanation of (A)
- (2) Both (A) and (R) are true but (R) is not the correct explanation of (A)
- (3) (A) is true but (R) is false
- (4) (A) is false but (R) is true

[NEET-2022]

57. Given below are two statements:

Statement I:

Decomposition is a process in which the detritus is degraded into simpler substances by microbes.

Statement II:

Decomposition is faster if the detritus is rich in lignin and chitin

In the life of the above statements, choose the correct answer form the options given below:

- (1) both Statement I and Statement II are correct
- (2) Both Statement I and Statement II are incorrect
- (3) Statement I is correct but Statement II is incorrect
- (4) Statement I is correct but Statement II is correct

58. Detritivores breakdown detritus into smaller particles. This process is called:

- (1) Catabolism
- (2) Fragmentation
- (3) Humification
- (4) Decomposition

| | ANSWER KEY | | | | | | | | | | | | | | | | | | | | | | | | |
|------|------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Que. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |
| Ans. | 3 | 2 | 1 | 2 | 3 | 3 | 1 | 1 | 3 | 4 | 2 | 1 | 2 | 1 | 3 | 2 | 4 | 2 | 3 | 4 | 1 | 4 | 1 | 3 | 2 |
| Que. | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
| Ans. | 4 | 4 | 3 | 1 | 3 | 4 | 4 | 2 | 1 | 4 | 3 | 3 | 1 | 3 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 3 | 2 | 3 |
| Que. | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | | | | | | | | | | | | | | | | | |
| Ans. | 4 | 2 | 2 | 4 | 3 | 1 | 3 | 2 | | | | | | | | | | | | | | | | | |