All India Civil Services Coaching Centre

(Under the aegis of Government of Tamil Nadu)

Answer Key Explanation

Test 1 – NCERT Environment

Maximum Questions: 100 **Maximum Marks: 200**

1. **Correct Answer: (c)**

Ecology

The term ecology is derived from the Greek word oikos, meaning 'home or place to live in' and logos, meaning 'study'. Literally, it is the study of the home of nature.

Ecology is defined as a scientific study of the relationship of the living organisms with each other as well as with their environment.

It deals with the ways in which organisms are moulded by their environment, how they make use of environmental resources, including energy flow and mineral cycling within the environment.

2. **Correct Option: (c)**

Statement 1 is incorrect: Grasslands rarely receive enough rain to support trees, but possess enough soil nutrients to feed large, grassy expanses.

Terrestrial Ecosystems

- At approximately 57 268 900 square miles, the terrestrial ecosystem covers just 29% of the globe. As these habitats are varied, terrestrial ecosystems are further broken down into six types.
- The deciduous forest ecosystem is found in temperate regions and experiences temperature and precipitation fluctuations according to four seasons.
- Current conservation goals include reintroducing apex predators after the culling practices of previous centuries, and providing an environment full with mature trees to make up for unregulated deforestation.
- Desert ecosystems can be hot and dry, semi-arid, coastal or cold. The feature that links these is a lack of water and the absence of a soil layer in which larger vegetation such as shrubs and trees can thrive.
- While indigenous life has adapted to the absence of water, a desert is still unable to support the populations of a wetter habitat.
- Substantially sized herbivores are unable to survive in a desert environment in large numbers, and this in turn limits the numbers of larger omnivores and carnivores.
- Grasslands are also known as prairies, pampas, savanna or steppe. They can be tropical or temperate, and are a link between desert and forest.
- They rarely receive enough rain to support trees, but possess enough soil nutrients to feed large, grassy expanses. This provides considerable energy for primary consumers. With a large population of producers, a grassland ecosystem can similarly support large herds of herbivores, which in turn feed consumers higher up in the food chain hierarchy.
- The taiga is a region of subarctic forest south of the Arctic Circle. It has layers of permafrost or rock under shallow soil, which make the soil marshy. The taiga supports huge numbers of conifers – slow growing, cold-resistant trees. Other plant life is small and includes lichen, marshland plants and small shrubs. The map below shows how this ecosystem is distributed across the globe.
- Tropical rainforests are probably the most quoted ecosystems in the field of

environmental conservation. Located around the Equator, constant rainfall and warmth together with a lack of seasons provide a stable climate, yet cloud and the tree canopy make the rainforest floor a dark place. Soil is leached of nutrients through constant precipitation. Plant life has adapted and is abundant, making the tropical rainforest ecosystem the terrestrial ecosystem with the most biodiversity.

- Tundra, the last of the six terrestrial biomes, is the treeless environment of the Arctic Circle. Climate change is rapidly changing this ecosystem, as warmer weather brings non-indigenous predators in, where they compete for limited prey. Certain shrubs are taking root as the Artic permafrost layer melts. These compete with lichen – the primary food source of caribou.

3. Correct Answer: (c)

Environment

- Everything that surrounds or affects an organism during its lifetime is collectively known as its environment. In biological terms, the environment constitutes the physical (nutrients, water, and air) and biological factors (biomolecules, organisms) along with their chemical interactions (chemical cycles – carbon cycle, nitrogen cycle, etc.) that affect an organism or a group of organisms.
- It is the natural component in which biotic (living) and abiotic (non-living) factors interact among themselves and with each other. These interactions shape the habitat and ecosystem of an organism.
- The relationship and interaction between organisms and its environment are highly complex.
- All organisms are dependent on the environment to carry out their natural life processes and to meet their physical requirements (like food, energy, water, oxygen, shelter).
- Options (a) and (b) are partially correct answers and form the subset of the most appropriate answer i.e. option (c).

4. Correct Option: (b)

Statement 2 is incorrect: Secondary productivity is defined as the rate of formation of new organic matter by consumers.

Productivity of an Ecosystem

- A constant input of solar energy is the basic requirement for any ecosystem to function and sustain.
- 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 (g–2) or energy (kcal m–2). The rate of biomass production is called productivity.
- It is expressed in terms of g–2 yr –1 or (kcal m–2) yr –1 to compare the productivity of different ecosystems.
- It can be divided into gross primary productivity (GPP) and net primary productivity (NPP).
- Gross primary productivity of an ecosystem is the rate of production of organic matter during photosynthesis.
- A considerable amount of GPP is utilised by plants in respiration.
- Gross primary productivity minus respiration losses (R), is the net primary productivity (NPP).

GPP – R = NPP

- Net primary productivity is the available biomass for the consumption to heterotrophs (herbiviores and decomposers).
- Secondary productivity is defined as the rate of formation of new organic matter by 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 types of ecosystems.

5. **Correct Answer: (c)**
Components of the Environment
- Water and Soil constitute the abiotic component of the environment.
- Non-Green Plants constitute the biotic component of the environment.

6. **Correct Option: (b)**
Option (b) is incorrect: If the animals eat other animals which in turn eat the plants (or their produce) they are called secondary consumers.

Producers and Consumers
- The green plant in the ecosystem terminology are called producers. In a terrestrial ecosystem, major producers are herbaceous and woody plants.
- Likewise, primary producers in an aquatic ecosystem are various species like phytoplankton, algae and higher plants.
- Starting from the plants (or producers) food chains or rather webs are formed such that an animal feeds on a plant or on another animal and in turn is food for another.
- The chain or web is formed because of this interdependency. No energy that is trapped into an organism remains in it for ever.
- The energy trapped by the producer, hence, is either passed on to a consumer or the organism dies.
- Death of organism is the beginning of the detritus food chain/web. All animals depend on plants (directly or indirectly) for their food needs. They are hence called consumers and also heterotrophs.
- If they feed on the producers, the plants, they are called primary consumers, and if the animals eat other animals which in turn eat the plants (or their produce) they are called secondary consumers. Likewise, you could have tertiary consumers too.
- Obviously the primary consumers will be herbivores. Some common herbivores are insects, birds and mammals in terrestrial ecosystem and molluscs in aquatic ecosystem.
- The consumers that feed on these herbivores are carnivores, or more correctly primary carnivores (though secondary consumers). Those animals that depend on the primary carnivores for food are labelled secondary carnivores.

7. **Correct Answer: (a)**
Levels of Organisations in Ecology
- A population is a group of organisms usually of the same species, occupying a defined area during a specific time.

8. **Correct Option: (a)**
Statement 2 is incorrect: The pyramid of biomass in sea is also generally inverted (not always) because the biomass of fishes far exceeds that of phytoplankton.

Ecological Pyramids
- An ecological pyramid is a graphical representation of the relationship between different organisms in an ecosystem.
- Each of the bars that make up the pyramid represents a different trophic level, and their order, which is based on who eats whom, represents the flow of energy.
- Energy moves up the pyramid, starting with the primary producers, or autotrophs, such as plants and algae at the very bottom, followed by the primary consumers, which feed on these plants, then secondary consumers, which feed on the primary consumers, and so on.
- The height of the bars should all be the same, but the width of each bar is based on the quantity of the aspect being measured.

Pyramid of Numbers
- This shows the number of organisms in each trophic level without any consideration for their size.

- This type of pyramid can be convenient, as counting is often a simple task and can be done over the years to observe the changes in a particular ecosystem.
- However, some types of organisms are difficult to count, especially when it comes to some juvenile forms.

Pyramid of Biomass

- This indicates the total mass of organisms at each trophic level. Usually, this type of pyramid is largest at the bottom and gets smaller going up, but exceptions do exist.
- The biomass of one trophic level is calculated by multiplying the number of individuals in the trophic level by the average mass of one individual in a particular area.
- This type of ecological pyramid solves some problems of the pyramid of numbers, as it shows a more accurate representation of the amount of energy contained in each trophic level, but it has its own limitations.
- For example, the time of year when the data are gathered is very important, since different species have different breeding seasons.
- Also, since it's usually impossible to measure the mass of every single organism, only a sample is taken, possibly leading to inaccuracies.
- The pyramid of biomass in sea is also generally inverted because the biomass of fishes far exceeds that of phytoplankton.
- Pyramid of Productivity
- The pyramid of productivity looks at the total amount of energy present at each trophic level, as well as the loss of energy between trophic levels.
- Since this type of representation takes into account the fact that the majority of the energy present at one trophic level will not be available for the next one, it is more accurate than the other two pyramids.
- This idea is based on Lindeman's Ten Percent Law, which states that only about 10% of the energy in a trophic level will go towards creating biomass.
- In other words, only about 10% of the energy will go into making tissue, such as stems, leaves, muscles, etc. in the next trophic level.
- The pyramid of productivity is the most widely used type of ecological pyramid, and, unlike the two other types, can never be largest at the apex and smallest at the bottom.
- It's an important type of ecological pyramid because it examines the flow of energy in an ecosystem over time.
- While a productivity pyramid always takes an upright pyramid shape, number pyramids are sometimes inverted, or don't take the shape of an actual pyramid at all.

9. Correct Answer: (b)

Levels of Organisations in Ecology

An Individual is considered as the basic unit of taxonomy and is denoted by a Latin binomial, e.g. Homo sapiens.

10. Correct Option: (d)

All statements are correct

Ecological Succession

- An important characteristic of all communities is that composition and structure constantly change in response to the changing environmental conditions.
- This change is orderly and sequential, parallel with the changes in the physical environment. These changes lead finally to a community that is in near equilibrium with the environment and that is called a climax community.
- The gradual and fairly predictable change in the species composition of a given area is called ecological succession.
- During succession some species colonise an area and their populations become more numerous, whereas populations of other species decline and even disappear.
- The entire sequence of communities that successively change in a given area are

called sere(s). The individual transitional communities are termed seral stages or seral communities.

- In the successive seral stages there is a change in the diversity of species of organisms, increase in the number of species and organisms as well as an increase in the total biomass.
- The present day communities in the world have come to be because of succession that has occurred over millions of years since life started on earth.
- Actually succession and evolution would have been parallel processes at that time. Succession is hence a process that starts where no living organisms are there – these could be areas where no living organisms ever existed, say bare rock; or in areas that somehow, lost all the living organisms that existed there.
- The former is called primary succession, while the latter is termed secondary succession. Examples of areas where primary succession occurs are newly cooled lava, bare rock, newly created pond or reservoir.
- The establishment of a new biotic community is generally slow. Before a biotic community of diverse organisms can become established, there must be soil.
- Depending mostly on the climate, it takes natural processes several hundred to several thousand years to produce fertile soil on bare rock.
- Secondary succession begins in areas where natural biotic communities have been destroyed such as in abandoned farm lands, burned or cut forests, lands that have been flooded. Since some soil or sediment is present, succession is faster than primary succession.
- At any time during primary or secondary succession, natural or human induced disturbances (fi re, deforestation, etc.), can convert a particular seral stage of succession to an earlier stage.
- Also such disturbances create new conditions that encourage some species and discourage or eliminate other species. Based on the nature of the habitat – whether it is water (or very wet areas) or it is on very dry areas – succession of plants is called hydrach or xerarch, respectively.
- Hydrarch succession takes place in wetter areas and the successional series progress from hydric to the mesic conditions.
- As against this, xerarch succession takes place in dry areas and the series progress from xeric to mesic conditions.
- Hence, both hydrarch and xerach successions lead to medium water conditions (mesic) – neither too dry (xeric) nor too wet (hydric).
- The species that invade a bare area are called pioneer species. In primary succession on rocks these are usually lichens which are able to secrete acids to dissolve rock, helping in weathering and soil formation.
- In primary succession in water, the pioneers are the small phytoplanktons, they are replaced with time by free-floating angiosperms, then by rooted hydrophytes, sedges, grasses and finally the trees.
- The climax again would be a forest. With time the water body is converted into land.
- In secondary succession the species that invade depend on the condition of the soil, availability of water, the environment as also the seeds or other propagules present.
- Since soil is already there, the rate of succession is much faster and hence, climax is also reached more quickly.
- All succession whether taking place in water or on land, proceeds to a similar climax community – the mesic.

11. Correct Answer: (b)

Levels of Organisations in Ecology

Ecology encompasses the study of individual, population, community, ecosystem, biome and biosphere which form the various levels of ecological organisation.

Individual

- Organism is an individual living being that has the ability to act or function independently.
- It may be a plant, animal, bacterium, fungi, etc.
- They are considered as the basic unit of taxonomy and are denoted by a Latin binomial, e.g. Homo sapiens.

Population

- Population is a group of organisms usually of the same species, occupying a defined area during a specific time.

Population growth rate:

- It refers to the percentage variation between the numbers of individuals in a population at two different times. Hence, the population growth rate can be positive or negative.
- The main factors that make population increase are birth and immigration.
- The main factors that make population decrease are death and emigration.
- The main limiting factors for the growth of the population can be abiotic or biotic components.

Population density:

- It refers to the relation between the number of individuals of a population and the area they occupy.

Community

- In order to survive, individuals of any one species depend on individuals of different species with which they actively interact in several ways.
- For example Animals require plants for food and trees for shelter. Plants require animals for pollination, seed dispersal, and soil microorganism to facilitate nutrient supply.

Ecosystem

- An ecosystem is a community of organisms interacting with each other and with their environment.
- It can be biotic (like green plants) or abiotic (like soil, climate, etc).

Biome

- A biome is a large naturally occurring community of flora and fauna occupying a major habitat. E.g. Rainforest biome or tundra biome.
- Plants and animals in a biome have common characteristics due to similar climates and can be found over a range of continents.

Biosphere

- The biosphere includes all living organisms on earth, together with the dead organic matter produced by them.

12. Correct Option: (d)

- Statements 1 is incorrect: During primary succession on land, fungi and lichen are the most common pioneer species.
- Statements 2 is incorrect: Pioneers of secondary successions often encounter resource-rich environments where competition with existing vegetation is reduced.

Pioneer Species

- The term pioneer is used to describe the species that first colonize new habitats created by disturbance.
- Although the term is usually applied to plants, microbial and invertebrate pioneer species are also sometimes recognized.
- For terrestrial habitats two groups of pioneers can be distinguished: those that colonize sites lacking developed organic soil and initiate primary succession and those that initiate secondary succession, often via recruitment from propagules in the soil.
- Pioneers of primary succession must cope with unfavourable conditions for establishment, and their growth and distribution is often restricted by available nutrient supply as a consequence of limited soil development.

- During primary succession on land, fungi and lichen are the most common pioneer species. In aquatic environments, phytoplankton (microscopic organisms that photosynthesize) are the common pioneer species.
- They break down minerals in the rock to form soil, which allow subsequent communities to colonize the area.
- In contrast, pioneers of secondary successions often encounter resource rich environments where competition with existing vegetation is reduced.
- In secondary succession on land, such as after a fire or when trees topple in forests, tree species like alders, birches and chir pine and many grass species can begin the succession process.
- Some of the fastest-growing plant species are pioneer herbs and shrubs, many of which have become important weeds in agricultural systems.
- Tropical forests also support pioneer tree species that regenerate in canopy gaps created by tree falls.
- Some of these pioneers are capable of growing to forest canopy within a decade and several are important timber species.
- The distinction between pioneer and non-pioneer life histories is difficult to delineate as traits such as growth or mortality rate, or shade-tolerance vary continuously among species.
- Nonetheless, a life-history trade off determined by growth in high light and survival in the shade limits the habitat range of pioneers of secondary successions and prevents populations from persisting long after the disturbance has passed.

13. Correct Answer: (b)

Ecosystem

- An ecosystem is defined as a structural and functional unit of biosphere consisting of community of living beings and the physical environment, both interacting and exchanging materials between them.
- It includes plants, trees, animals, fish, birds, micro-organisms, water, soil, and people.
- When an ecosystem is healthy (i.e. sustainable) it means that all the elements live in balance and are capable of reproducing themselves.
- Everything that lives in an ecosystem is dependent on the other species and elements that are also part of that ecological community. If one part of an ecosystem is damaged or disappears, it has an impact on everything else.

14. Correct Option: (c)

All of the above are the services provided by the ecosystem.

Ecosystem Services

- The value of nature to people has long been recognized, but in recent years, the concept of ecosystem services has been developed to describe these various benefits. An ecosystem service is any positive benefit that wildlife or ecosystems provide to people. The benefits can be direct or indirect—small or large.
- Provisioning Services: When people are asked to identify a service provided by nature, most think of food. Fruits, vegetables, trees, fish, and livestock are available to us as direct products of ecosystems.
- A provisioning service is any type of benefit to people that can be extracted from nature. Along with food, other types of provisioning services include drinking water, timber, wood fuel, natural gas, oils, plants that can be made into clothes and other materials, and medicinal benefits.
- **Regulating Services:** Ecosystems provide many of the basic services that make life possible for people. Plants clean air and filter water, bacteria decompose wastes, bees pollinate flowers, and tree roots hold soil in place to prevent erosion. All these processes work together to make ecosystems clean, sustainable, functional, and resilient to change. A regulating

service is the benefit provided by ecosystem processes that moderate natural phenomena. Regulating services include pollination, decomposition, water purification, erosion and flood control, and carbon storage and climate regulation.

- **Cultural Services:** As we interact and alter nature, the natural world has in turn altered us. It has guided our cultural, intellectual, and social development by being a constant force present in our lives. The importance of ecosystems to the human mind can be traced back to the beginning of mankind with ancient civilizations drawing pictures of animals, plants, and weather patterns on cave walls. A cultural service is a non-material benefit that contributes to the development and cultural advancement of people, including how ecosystems play a role in local, national, and global cultures; the building of knowledge and the spreading of ideas; creativity born from interactions with nature (music, art, architecture); and recreation.
- **Supporting Services:** The natural world provides so many services, sometimes we overlook the most fundamental. Ecosystems themselves couldn't be sustained without the consistency of underlying natural processes, such as photosynthesis, nutrient cycling, the creation of soils, and the water cycle. These processes allow the Earth to sustain basic life forms, let alone whole ecosystems and people. Without supporting services, provisional, regulating, and cultural services wouldn't exist.

15. Correct Answer: (d)

- Difference between Ecology, Environment, and Ecosystem.
- Ecology is the study of the interactions between organisms and its surroundings occurring within an ecosystem or environment.
- An ecosystem is a functional unit of the environment.
- Ecosystem consists of Producers, Consumers, Decomposers and their relationship among each other.
- An environment is a group of ecosystems.
- Habitat is an area where an organism lives.
- Biosphere is the region on earth that supports life.

16. Correct Option: (b)

Option (b) is correct: Seed Bank is ex-situ methods of conservation.

In-situ and Ex-situ Conservation

- In-situ Conservation is the methods of conserving all the living species, especially the wild and endangered species in their natural habitats and environment. In-situ conservation of Biodiversity includes biosphere reserves, national parks, wildlife sanctuaries, etc.
- Ex-situ Conservation is the methods of conserving all the living species in the artful habitats that reflect their natural living habitats. Ex-situ Conservation of Biodiversity comprises of aquariums, botanical gardens, Cryopreservation, DNA banks, zoos, etc.

17. Correct Answer: (c)

Abiotic component of the ecosystem

- Abiotic components are the inorganic and non-living parts of the world.
- The abiotic part consists of soil, water, air, and light energy etc.
- It also involves chemicals like oxygen, nitrogen etc. and physical processes including volcanoes, earthquakes, floods, forest fires, climates, and weather conditions.
- Following are the examples of abiotic component of ecosystem:

Energy

- Energy from the sun is essential for maintenance of life.
- In the case of plants, the sun directly supplies the necessary energy.

- Since animals cannot use solar energy directly they obtain it indirectly by eating plants or animals or both.

Rainfall

- Majority of biochemical reactions take place in an aqueous medium.
- Water helps to regulate body temperature.
- Further, water bodies form the habitat for many aquatic plants and animals.

Temperature

- Temperature is a critical factor of the environment as organisms can tolerate only a certain range of temperature and humidity.

Atmosphere

- The earth's atmosphere is responsible for creating conditions suitable for the existence of a healthy biosphere on this planet.

Substratum

- Land is covered by soil and a wide variety of microbes, protozoa, fungi and small animals (invertebrates) thrive in it.
- Roots of plants pierce through the soil to absorb water and nutrients.

Materials:

- Organic compounds such as proteins, carbohydrates, lipids, humic substances are formed from inorganic compound on decomposition.
- Inorganic compounds such as carbon dioxide, water, sulphur, nitrates, phosphates, and ions of various metals are essential for organisms to survive.
- Latitude and altitude Latitude has a strong influence on an area's temperature, resulting in change of climates such as polar, tropical, and temperate. These climates determine different natural biomes.
- As the altitude increases, the air becomes colder and drier, affecting wild life accordingly.

18. Correct Option: (b)

Option (b) is incorrectly matched: Pachmarhi is located in Madhya Pradesh

Biosphere Reserves

- Cold Desert, Himachal Pradesh
- Nanda Devi, Uttrakhand
- Khangchendzonga, Sikkim
- Dehang-Debang, Arunachal Pradesh
- Manas, Assam
- Dibru-Saikhowa, Assam
- Nokrek, Meghalaya
- Panna, Madhya Pradesh
- Pachmarhi, Madhya Pradesh
- Achanakmar-Amarkantak, Madhya Pradesh-Chhattisgarh
- Kachchh, Gujarat (Largest Area)
- Similipal, Odisha
- Sundarban, West Bengal
- Seshachalam, Andhra Pradesh
- Agasthyamala, Tamil Nadu-Kerala Border
- Nilgiri, Tamil Nadu-Kerala (First to be Included)
- Gulf of Mannar, Tamil Nadu
- Great Nicobar, Andaman & Nicobar Island

19. Correct Answer: (a)

Biotic Components of Ecosystem

- Biotic components include living organisms comprising plants, animals and microbes and are classified according to their functional attributes into producers and consumers.
- Primary producers - Autotrophs (self-nourishing)
- Primary producers are basically green plants (and certain bacteria and algae).
- They synthesise carbohydrate from simple inorganic raw materials like carbon dioxide and water in the presence of sunlight by the process of photosynthesis for themselves, and supply indirectly to other non-producers.
- In terrestrial ecosystem, producers are basically herbaceous and woody plants, while in aquatic ecosystem producers are various species of microscopic algae.
- Consumers - Heterotrophs or phagotrophs (other nourishing)

- Consumers are incapable of producing their own food.
- They depend on organic food derived from plants, animals or both.
- Consumers can be divided into two broad groups namely micro and macro consumers.
- Micro consumers - Saprotrophs (decomposers or osmotrophs)
- They are bacteria and fungi which obtain energy and nutrients by decomposing dead organic substances (detritus) of plant and animal origin.
- Earthworm and certain soil organisms (such as nematodes, and arthropods) are detritus feeders and help in the decomposition of organic matter and are called detrivores.

Macro consumers

- They feed on plants or animals or both and are categorised on the basis of their food sources.
- Herbivores are primary consumers which feed mainly on plants e.g. cow, rabbit.
- Secondary consumers feed on primary consumers e.g. wolves.
- Carnivores which feed on secondary consumers are called tertiary consumers e.g. lions which can eat wolves.
- Omnivores are organisms which consume both plants and animals e.g. man, monkey.

20. Correct Option: (d)

Option (d) is correct

Invasive alien species

- An alien species is a species introduced outside its normal distribution. According to experts, alien species become 'invasive' when they are introduced deliberately or accidentally outside their natural areas, where they out-compete the native species and upset the ecological balance.
- The most common characteristics of invasive species are rapid reproduction and growth, high dispersal ability, ability to survive on various food types, and in a wide range of environmental conditions and the ability to adapt physiologically to new conditions, called phenotypic plasticity.
- Some of them are Water Hyacinth, Thorn Apple, and Viper grass.

21. Correct Answer: (d)

Goods and Services provided by ecosystems include:

- Provision of food, fuel and fibre
- Provision of shelter and building materials
- Purification of air and water
- Detoxification and decomposition of wastes
- Stabilization and moderation of the Earth's climate
- Moderation of floods, droughts, temperature extremes and the forces of wind.
- Generation and renewal of soil fertility, including nutrient cycling.
- Pollination of plants, including many crops Control of pests and diseases
- Maintenance of genetic resources as key inputs to crop varieties and livestock breeds, medicines, and other products
- Cultural and aesthetic benefits
- Mapped In ML Test 1(Ecology and Environment)
- Environmental Ecology-Adaptation of Species and Interactions

22. Correct Option: (d)

All statements are correct

Indian biodiversity hotspots

- **Himalaya:** Includes the entire Indian Himalayan region (and that falling in Pakistan, Tibet, Nepal, Bhutan, China and Myanmar).
- **Indo-Burma:** Includes entire North-eastern India, except Assam and Andaman group of Islands (and Myanmar, Thailand, Vietnam, Laos, Cambodia and southern China)
- Western Ghats and Sri Lanka: Includes entire Western Ghats (and Sri Lanka).
- **Sundalands:** Includes Nicobar group of Islands (and Indonesia, Malaysia, Singapore, Brunei, Philippines).

23. Correct Answer: (a)

List I	List II
A. Reproductive niche	1. How and when it reproduces
B. Habitat niche	2. Where it lives
C. Food niche	3. What it eats or decomposes

Niche

- Niche refers to the unique functional role and position of a species in its habitat or ecosystem.
- The functional characteristics of a species in its habitat is referred to as "niche" in that common habitat.
- A niche is unique for a species, which means no two species have exact identical niches.
- Niche plays an important role in conservation of organisms.
- If we have to conserve species in its native habitat we should have knowledge about the niche requirements of the species and should
- ensure that all requirements of its niche are fulfilled.

Types of Niche:

- **Habitat niche -** where it lives; Food niche- what is eats or decomposes & what species it competes with
- **Reproductive niche -** how and when it reproduces.
- **Physical & chemical niche -** temperature, land shape, land slope, humidity & other requirement.

Difference between niche and habitat

- The habitat of a species is like its 'address' (i.e. where it lives) whereas niche can be thought of as its "profession" (i.e. activities and responses specific to the species).
- A niche is unique for a species while many species share the habitat.
- No two species in a habitat can have the same niche. This is because of the competition with one another until one is displaced. For example, a large number of different species of insects may be pests of the same plant, but they can co-exist as they feed on different parts of the same plant.

24. Correct Option: (c)

- Statement 2 is incorrect: Ecotone also appears where one body water meets another at boundary between the water and land.

Ecotone

- An Ecotone is a transitional area of different Ecosystems, such as forest and grasslands.
- An Ecotone may exist along a broad belt or in a small pocket, such as forest clearing, whereas two local communities blend together. Ecotone may be very narrow or quite wide. It has conditions intermediate to the adjacent ecosystems. Hence it is a zone of tension.
- An Ecotonal area often has a higher density organism of one species and a greater number of species than are found in either flanking community. This tendency for increased diversity within the ecosystem is referred to as the "Edge effect".
- Ecotone often has a large number of species and larger population densities than the communities on either side.
- Ecotone also appears where one body water meets another at boundary between the water and land ex: marshes.
- Grasslands is an ecotone between forest and desert ecosystem.

25. Correct Answer: (b)

Biome

- The terrestrial part of the biosphere is divisible into enormous regions called biomes, which are characterized, by climate, vegetation, animal life, and general soil type.
- No two biomes are alike.

- The climate determines the boundaries of a biome and abundance of plants and animals found in each one of them.
- The most important climatic factors are temperature and precipitation.

26. Correct Option: (a)

- Statement 3 is incorrect: Food web has an effect on improving the adaptability and competitiveness of the organism.

Difference between food chain and food web:

- A food web indicates all possible transfer of energy and nutrients among the organisms in an ecosystem whereas a food chain traces only one pathway of the food.
- Food web increases the stability of the ecosystem where as separate food chain increases the instability of the ecosystem.
- Food chain does not have any effect on improving the adaptability and competitiveness of the organism but food web has an effect on improving the adaptability and competitiveness of the organism.

27. Correct Answer: (d)

Types of Aquatic Ecosystem

S. No	Aquatic ecosystem	Characteristics
1	Fresh Water Ecosystem	Fresh water ecosystem are classified as lotic (moving water) or lentic (still or stagnant water). Lotic water system includes freshwater streams, springs, rivulets, creeks, brooks, and rivers. Lentic water bodies include pools, ponds, some swamps, bogs and lakes. They vary considerably in physical, chemical and biological characteristics.
2	Marine Ecosystem	Nearly three – quarter of earth's surface is covered by ocean with an average depth of 3,750 m and with salinity 35 ppt, (parts per thousand), about 90 per cent of which is sodium chloride.
3	Estuaries	Coastal bays, river mouths and tidal marshes form the estuaries. In estuaries, fresh water from rivers meet ocean water and the two are mixed by action of tides. Estuaries are highly productive as compared to the adjacent river or sea.
4	Coral reef	Corals are a kind of calcareous rock, chiefly made of the skeletons of minute sea organisms called 'polyps'. Coral reefs and atolls are formed due to the accumulation and compaction of the skeletons of these lime secreting organisms. They, over a period of time transform or evolve into coral islands (Lakshadweep), occur in different forms and colours, depending upon the nature of salts or constituents they are made of.
5	Mangrove	Mangroves represent a characteristic littoral (near the seashore) forest ecosystem. These are mostly evergreen forests, grow below the high water level of spring tides. They are highly productive ecosystems, and the trees may vary in

		height from 8 to 20 m. They protect the shoreline from the effect of cyclones and tsunamis. They are breeding and spawning ground for many commercially important fishes. Since mangroves are located between the land and sea, they represent the best example of ecotone.
6	Estuaries	Coastal bays, river mouths, and tidal marshes form the estuaries. In estuaries, freshwater from rivers meets ocean water and the two are mixed by action of tides. Estuaries are highly productive as compared to the adjacent river or sea.

28. Correct Option: (a)

- Statement 2 is incorrect: Eastern Himalayas and Western Ghats are the biodiversity hotspots in India.

Biodiversity Hotspot

- A biodiversity hotspot is a bio-geographic region with a significant reservoir of biodiversity that is under threat from humans.
- To qualify as a biodiversity hotspot, a region must meet two strict criteria:
- It must contain at least 0.5% or 1,500 species of vascular plants as endemics, and
- It must have lost at least 70% of its primary vegetation.
- In India, there are 4 biodiversity hotspots- The Western Ghats, The Himalayas, Indo-Burma Region, Sundaland– cover our country's exceptionally high biodiversity regions.

29. Correct Answer: (b)

Aquatic ecosystem Characteristics

Aquatic ecosystem Characteristics

A. Estuaries — 3. Fresh water from rivers meet ocean water
B. Coral reef — 2. Made up of the skeletons of minute sea organisms called 'polyps'
C. Mangrove — 1. Littoral forest ecosystem

30. Correct Option: (a)

Option (a) is correct: There is no evidence to prove that oxides of sulphur and Carbon Monoxide are cancerous.

- Hydrocarbons are composed of hydrogen and carbon only and are formed by incomplete combustion of fuel used in automobiles.
- Hydrocarbons are carcinogenic, i.e., they cause cancer. They harm plants by causing ageing, breakdown of tissues and shedding of leaves flowers and twigs.
- Oxides of sulphur are produced when sulphur containing fossil fuel is burnt. The most common species, sulphur dioxide, is a gas that is poisonous to both animals and plants.
- It has been reported that even a low concentration of sulphur dioxide causes respiratory diseases e.g., asthma, bronchitis, emphysema in human beings.
- There is no evidence to prove that oxides of sulphur are cancerous. Carbon monoxide (CO) is one of the most serious air pollutants.
- It is a colourless and odourless gas, highly poisonous to living beings because of its ability to block the delivery of oxygen to the organs and tissues.
- Although there are no human or animal studies investigating CO exposure and cancer, there is no information that would indicate it has any carcinogenic potential.

31. Correct Answer: (d)

Components of Environment

- The four major components of environment include lithosphere, hydrosphere, atmosphere and biosphere, corresponding to rocks, water, air and life respectively.

- Lithosphere is the outermost layer of earth called crust, which is made of different minerals.
- Its depth can reach up to 100 kilometers and is found on both land (terrestrial crust) and oceans (oceanic crust). The main component of lithosphere is earth's tectonic plates.
- Hydrosphere comprises of all forms of water bodies on earth including oceans, seas, rivers, lakes, ponds, streams etc. It covers 70% of earth's surface. 97.5% of water found on Earth is in the oceans in the form of salt water.
- Only 2.5 % of water on Earth is freshwater. Out of this, 30.8% is available as groundwater and 68.9% is in frozen forms as in glaciers. Amount of 0.3% is available in rivers, reservoirs and lakes and is easily accessible to man.
- Atmosphere is gaseous layer enveloping the Earth. The atmosphere with oxygen in abundance is unique to Earth and sustains life. It mainly comprises 78.08% nitrogen, 20.95% oxygen, 0.93% argon, 0.038% carbon dioxide, and traces of hydrogen, helium, and noble gases. The amount of water vapour present is variable.
- Biosphere refers to all the regions on Earth where life exists. The ecosystems that support life could be in soil, air, water or land. The term Biosphere was coined by Geologist Edward Suess who used this term for place on Earth where life can be found.
- Biosphere refers to the sum total of all living matter, the biomass or biota. It extends from the polar ice caps to the equator, with each region harbouring some life form suitable to the conditions there.

32. Correct Option: (d)

All statements are correct

Causes of Biodiversity Losses:

- The accelerated rates of species extinctions that the world is facing now are largely due to human activities.

There are four major causes:

Habitat loss and fragmentation:

- This is the most important cause driving animals and plants to extinction. The Amazon rain forest (it is so huge that it is called the 'lungs of the planet') harbouring probably millions of species is being cut and cleared for cultivating soya beans or for conversion to grasslands for raising beef cattle.
- Besides total loss, the degradation of many habitats by pollution also threatens the survival of many species. When large habitats are broken up into small fragments due to various human activities, mammals and birds requiring large territories and certain animals with migratory habits are badly affected, leading to population declines.

Over-exploitation:

- Humans have always depended on nature for food and shelter, but when 'need' turns to 'greed', it leads to over-exploitation of natural resources. Many species extinctions in the last 500 years) were due to overexploitation by humans.

Alien species invasions:

- When alien species are introduced unintentionally or deliberately for whatever purpose, some of them turn invasive, and cause decline or extinction of indigenous species. The Nile perch introduced into Lake Victoria in east Africa led eventually to the extinction of an ecologically unique assemblage of more than 200 species of cichlid fish in the lake.

Co-extinctions:

- When a species becomes extinct, the plant and animal species associated with it in an obligatory way also become extinct. When a host fish species becomes extinct, its unique assemblage of parasites also meets the same fate.

33. Correct Option: (c)

Both statements are correct

Patterns of Biodiversity

- Species diversity decreases as we move away from the equator towards the poles. With very few exceptions, tropics (latitudinal range of 23.5° N to 23.5° S) harbour more species than temperate or polar areas.
- Colombia located near the equator has nearly 1,400 species of birds while New York at 41° N has 105 species and Greenland at 71° N only 56 species.
- India, with much of its land area in the tropical latitudes, has more than 1,200 species of birds.
- A forest in a tropical region like Ecuador has up to 10 times as many species of vascular plants as a forest of equal area in a temperate region like the Midwest of the USA.
- The largely tropical Amazonian rain forest in South America has the greatest biodiversity on earth- it is home to more than 40,000 species of plants, 3,000 of fishes, 1,300 of birds, 427 of mammals, 427 of amphibians, 378 of reptiles and of more than 1,25,000 invertebrates.

34. Correct Option: (b)

Option (b) is correct: Bioprospecting is exploring molecular, genetic and species level diversity for products of economic importance.

Bioprospecting

- More than 25 per cent of the drugs currently sold in the market worldwide are derived from plants and 25,000 species of plants contribute to the traditional medicines used by native peoples around the world.
- Nobody knows how many medicinally useful plants there are in tropical rain forests waiting to be explored.
- With increasing resources put into 'bioprospecting' (exploring molecular, genetic and species-level diversity for products of economic importance), nations endowed with rich biodiversity can expect to reap enormous benefits.

35. Correct Option: (a)

Option (a) is correct

Biomes

- Biomes are very large ecological areas on the earth's surface, with fauna and flora (animals and plants) adapting to their environment. Biomes are often defined by abiotic factors such as climate, relief, geology, soils and vegetation. Plants or animals in any of the biomes have special adaptations that make it possible for them to exist in that area.

There are five major categories of biomes on earth.

- **The Desert Biomes:** They are the Hot and Dry Deserts, Semi-Arid Deserts, Coastal Deserts and Cold Deserts.
- **The Aquatic Biomes:** Aquatic biomes are grouped into two, Freshwater Biomes (lakes and ponds, rivers and streams, wetlands) and Marine Biomes (oceans, coral reefs and estuaries)
- **The Forest Biomes:** There are three main biomes that make up Forest Biomes. These are the Tropical Rainforest, Temperate and Boreal Forests (also called the Taiga)
- **The Grassland Biomes:** There are two main types of grassland biomes: the Savannah Grasslands and the Temperate Grasslands
- **The Tundra Biomes:** There are two major tundra biomes-The Arctic Tundra and the Alpine Tundra.

36. Correct Answer: (a)

Energy Flow in an Ecosystem

- Except for the deep sea hydro-thermal ecosystem, Sun is the only source of energy for all ecosystems on the Earth.
- Of the total incident solar radiation, less than 50 percent of it is photosynthetically active radiation (PAR).

- Plants capture only 2-10 percent of the PAR and this small amount of energy sustains the entire living world.

Energy flow through the trophic level

- A trophic level is the representation of energy flow in an ecosystem.
- Energy flows through the trophic levels from producers to subsequent trophic levels is unidirectional.
- Energy level decreases from the first trophic level upwards due to the loss of energy in the form of heat at each trophic level.
- This energy loss at each trophic level is quite significant. Hence there are usually not more than four-five trophic levels (beyond this the energy available is negligible to support an organism).

37. Correct Answer: (b)

Ecological Pyramids

- An ecological pyramid is a graphical representation designed to show the biomass or bio productivity at each trophic level in a given ecosystem.
- Ecological pyramids do not take into account the same species belonging to two or more trophic levels.

Types of ecological pyramids

- There are three types of ecological pyramids :
  1. pyramid of number
  2. pyramid of biomass
  3. pyramid of energy

Pyramid of number

- Pyramid of the number represents the total number of individuals of different species (population) at each trophic level.
- Depending upon the size, the pyramid of numbers may not always be upright, and may even be completely inverted.
- It is very difficult to count all the organisms in a pyramid of numbers and so the pyramid of numbers does not completely define the trophic structure for an ecosystem.

Pyramid of biomass

- Pyramid of biomass is usually determined by collecting all organisms occupying each trophic level separately and measuring their dry weight.
- This overcomes the size difference problem because all kinds of organisms at a trophic level are weighed and not counted.
- Each trophic level has a certain mass of living material at a particular time called the standing crop.
- The standing crop is measured as the mass of living organisms (biomass) or the number in a unit area.
- The pyramid of biomass in the sea is also generally inverted.

Food web

- The natural interconnection of the food chain is called a food web

38. Correct Answer: (b)

Food Chain

- Transfer of food energy from green plants (producers) through a series of organisms with repeated eating and being eaten link is called a food chain.
- E.g. Grasses ⇒ Grasshopper ⇒ Frog ⇒ Snake ⇒ Hawk/Eagle.
- Each step in the food chain is called the trophic level.
- A food chain starts with producers and ends with top carnivores.
- The trophic level of an organism is the position it occupies in a food chain.
- It illustrates the order in which a chain of organisms feeds upon each other.

Types of Food Chains

- Grazing Food Chain The consumers who start the food chain, utilising the plant or plant part as their food, constitute the grazing food chain.
- For example, in a terrestrial ecosystem, the grass is eaten by a caterpillar, which is eaten by lizard and lizard is eaten by a snake.

- In Aquatic ecosystem phytoplankton (primary producers) are eaten by zooplanktons which are eaten by fishes and fishes are eaten by pelicans (water bird).
- Detritus Food Chain This type of food chain starts from the organic matter of dead and decaying animals and plant bodies from the grazing food chain.
- Dead organic matter or detritus feeding organisms are called detrivores or decomposers.
- The detrivores are eaten by predators.

Grazing Food Chain (GFC) V/S Detritus Food Chain (DFC)

- In an aquatic ecosystem, the grazing food chain is the major conduit for energy flow.
- On the other hand, in a terrestrial ecosystem, a much larger fraction of energy flows through the detritus food chain (DFC) than through the grazing food chain(GFC).
- In a terrestrial ecosystem, a much larger fraction of energy flows through the detritus food chain than through the grazing food chain.

Basis - Grazing Food Chain v/s Detritus Food Chain

- **Definition -** The grazing food chain begins in the autotrophs (green plants). The detritus food chain starts from the Detritivores.
- Energy Supply In the grazing food chain, the energy is taken from the sunlight as green plants prepare food in its presence. In detritus food chain, the main energy source is dead organic matter.
- Organisms In grazing food chain macroscopic organisms are included. In detritus food chain subsoil organisms are involved, that could be macroscopic or microscopic.
- Number of Energy Releases a lesser quantity of energy into the air. Releases a greater quantity of energy to the air.

39. Correct Answer: (d)

Detritus Food Chain

- This type of food chain starts from the organic matter of dead and decaying animals and plant bodies from the grazing food chain.
- Dead organic matter or detritus feeding organisms are called detrivores or decomposers.
- The detrivores are eaten by predators.

40. Correct Answer: (a)

Food Web

- "A food web illustrates, all possible transfers of energy and nutrients among the organisms in an ecosystem, whereas a food chain traces only one pathway of the food".
- If any of the intermediate food chains are removed, the succeeding links of the chain will be affected largely.
- The food web provides more than one alternative for food to most of the organisms in an ecosystem and therefore increases their chance of survival.
- For example, grasses may serve food for rabbits or grasshoppers or goats or cows. Similarly, a herbivore may be a food source for many carnivorous species.
- The presence of complex food webs increases the stability of the ecosystem.
- More complex food webs improve the adaptability and competitiveness of the organisms. Also, food availability and preferences of food of the organisms may shift seasonally. E.g. we eat watermelon in summer and peaches in the winter.
- Thus, there are interconnected networks of feeding relationships that take the form of food webs.

41. Correct Answer: (b)

- Predation and parasitism are two types of negative biotic interactions between the organisms living in the Earth.
- Parasitism is an interaction between a parasite and a host in which the former obtains benefits at the cost of later. A parasite does not cause the death of the

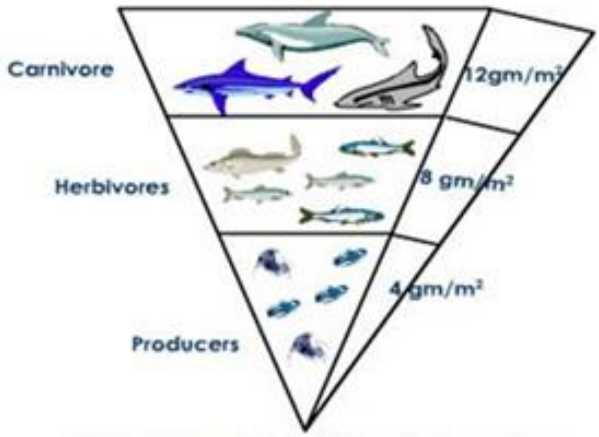
host. Whereas Predation is an association between two species, where one species (predator) kills to feed on the prey. Hence, statement 1 is not correct.

- In Parasitism the weak feed on the strong while in predation it is strong that feeds on the weak.
- Hence, statement 2 is correct.
- For example, Glochidium larva attaches to the fins of a fish is an example of parasitism and Birds feeding on fish is an example of predation.

42. Correct Answer: (d)

Pyramid of Biomass

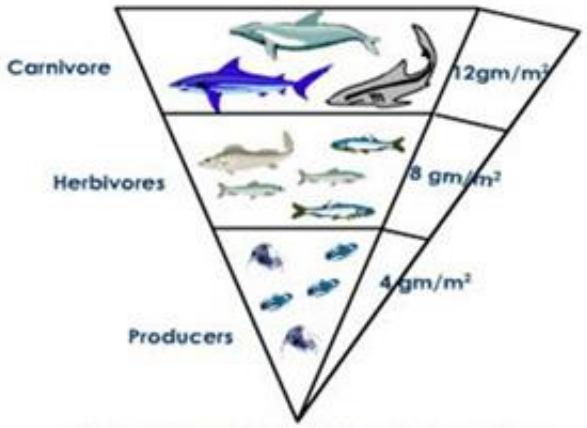
- A pyramid of biomass is a graphical representation of biomass present in a unit area of various trophic levels.
- Pyramid of biomass represents the total dry weight of all organisms at each trophic level at a particular time.
- In ecological terms, biomass refers to the total mass of all living or organic matter that inhabit an ecosystem at any given point of time.
- In order to overcome the shortcomings of the pyramid of numbers, the pyramid of biomass is used.
- In this approach individuals in each trophic level are weighed instead of being counted. Hence, this overcomes the size difference problem.
- This gives us a pyramid of biomass, i.e., the total dry weight of all organisms at each trophic level at a particular time.
- Dry weight refers to the weight of a plant (or organism) after all its water content has been removed by drying.
- Pyramid of biomass - upright For most ecosystems on land, the pyramid of biomass has a large base of primary producers with a smaller trophic level perched on top.
- Eg: terrestrial ecosystem



Inverted Pyramid in an Aquatic Ecosystem

Pyramid of biomass - inverted In the case of an inverted pyramid, the best example is the pond ecosystem.

The mass of the phytoplankton, the main producers of the ecosystem, is less than that of the consumers, which are generally fish and other insects.



Inverted Pyramid in an Aquatic Ecosystem

Limitation of the pyramid of biomass

- One of the main limitations of a biomass pyramid is that every trophic level seems to have more energy than it truly does.
- A good example to illustrate this is when human beings consume another animal.
- The mass of the animal's bones is calculated.
- However, the mass of the bones is not actually utilized in the next level of the pyramid of biomass.

43. Correct Answer: (d)

- Organisms living in this earth are interlinked to each other in one way or other. The interaction between the organisms is fundamental for the survival and functioning of the ecosystem as a whole.
- Antibiosis is a negative interaction in which an organism produces harmful secretions. In this type of relationship, none of the population is benefited. Hence, option (d) is correct.
- For example, some species of blue-green algae that grows in ponds produce toxic substances that kilt fishes as well. In marine waters, the population of some microbes popularly known as red tide cause the destruction of fish and other animals.
- Intraspecific competition is the competition between organisms of the same species.
- Predation is an association between two species, where one species kills to feed on the other.
- Exploitation is the relationship in which one organism is benefited by direct utilization of another

44. Correct Answer: (d)

Pyramid of Energy

- An energy pyramid is useful in quantifying the transfer of energy from one organism to another along a food chain.
- The pyramid of energy is always upright and can never be inverted.
- This is because when energy flows from a particular trophic level to the next trophic level, some energy is always lost as heat at each step.
- This idea is based on Lindeman's Ten Percent Law, which states that only about 10% of the energy in a trophic level will go towards creating biomass (such as stems, leaves, muscles, etc) in the next trophic level.
- The rest is used in respiration, hunting, and other activities, or is lost to the surroundings as heat. This makes the flow of energy in an ecosystem 'unidirectional'.
- The energy pyramid concept helps to explain the phenomenon of the biological magnification-the tendency for toxic substances to increase in concentration progressively at higher levels of the food chain.

45. Correct Answer: (a)

- Grasslands are found on every continent except Antarctica. These terrestrial ecosystems occupy roughly 19 percent of the earth's surface. They are characterised by treeless herbaceous plants dominated by a wide variety of grass

Features of Grasslands:

- The grasslands are found where rainfall is about 25-75 cm per year, not enough to support a forest, but more than that of a true desert. Typical grasslands are vegetation formations that are generally found in temperate climates.
- Grasslands are dominated by grasses. Large shrubs or trees are not found. Hence, statement 2 is not correct.
- Grasslands have a rich variety of animals. Hence, statement 1 is correct.
- The soil is always exposed, sometimes rocky but more often sandy with fixed or mobile dunes.
- Forage is available only during the brief wet season. Boreal forest soils are characterized by thin podzols. Hence, statement 3 is not correct.
- Grasslands have been the home for grazing animals for millions of years.

46. Correct Answer: (c)

Bio-magnification

- Bio-magnification refers to the tendency of pollutants to concentrate as they move from one trophic level to the next.
- Thus, in bio-magnification, there is an increase in the concentration of a pollutant from one link in a food chain to another.

- The energy pyramid concept helps to explain the phenomenon of the biological magnification-the tendency for toxic substances to increase in concentration progressively at higher levels of the food chain.

47. Correct Answer: (a)

- Wetland types found in coastal watersheds include salt marshes, bottomland hardwood swamps, fresh marshes, mangrove swamps, etc.
- Flood Protection: Coastal wetlands protect upland areas, including valuable residential and commercial property, from flooding due to sea-level rise and storms. Hence option 4 is correct.
- Coastal wetlands provide habitat for many federally threatened and endangered species, They act as a habitat for migratory birds and animals. Hence option 1 is correct.
- Coastal Wetlands can improve water quality by removing pollutants from surface waters. Three pollutant removal processes provided by wetlands are particularly important: sediment trapping, nutrient removal, and chemical detoxification. Hence option 3 is correct.
- Recharges a drinking water source, such as a wellhead or source protection area. Reduces levels of contaminants in surface waters that recharge underlying or adjacent ground waters such as wells. Hence option 4 is correct.
- Enhances or protects water quality through chemical action, by the removal of nutrients, by the retention or removal of sediments or organic matter, or by moderating the adverse water quality effects of soil erosion or storm water runoff.

48. Correct Answer: (d)

- Photochemical smog is a mixture of pollutants that are formed when nitrogen oxides and volatile organic compounds (VOCs) react to sunlight, creating a brown haze above cities. It occurs in warm, dry, and sunny climates. The main components of the photochemical smog result from the action of sunlight on unsaturated hydrocarbons and nitrogen oxides produced by automobiles and factories.
- Photochemical smog has a high concentration of oxidizing agents and is, therefore, called oxidizing smog.

Formation of Photochemical Smog:

- When fossil fuels are burnt, a variety of pollutants are emitted into the earth's troposphere including hydrocarbons (un-burnt fuels) and nitric oxide (NO). When these pollutants build up to sufficiently high levels, a chain reaction occurs from their interaction with sunlight in which NO is converted into nitrogen dioxide (NO2).
- This NO2 in turn absorbs energy from sunlight and breaks it up into nitric oxide and free oxygen atoms.

✓ $NO2(g) \rightarrow NO(g) + O(g)$

- Oxygen atoms are very reactive and combine with the O2 in the air to produce ozone.

✓ $O(g) + O2(g) \rightarrow O3(g)$

- The ozone formed in the above reaction reacts rapidly with the NO to regenerate NO2. NO2 is a brown gas and at sufficiently high levels can contribute to haze.

✓ $NO(g)+O(g) \rightarrow NO(g)+O(g)$

- Ozone is a toxic gas and both NO2 and O3 are strong oxidizing agents and can react with the unburnt hydrocarbons in the polluted air to produce chemicals such as formaldehyde, acrolein, and peroxyacetyl nitrate (PAN).

Effects of Photochemical Smog:

- The common components of photochemical smog are ozone, nitric oxide, acrolein, formaldehyde, and peroxyacetyl nitrate (PAN). Photochemical smog causes serious health problems. Both ozone and PAN act as powerful eye

irritants. Ozone and nitric oxide irritate the nose and throat and their high concentration causes headache, chest pain, dryness of the throat, cough and difficulty in breathing. Hence option (d) is the correct answer.

49. Correct Answer: (c)

Biogeochemical Cycle

- Biogeochemical cycling refers to the movement of nutrients from the environment into plants and animals and again back to the environment.
- Carbon, hydrogen, oxygen, nitrogen, and phosphorus as elements and compounds make up 95% of the mass of all living organisms.
- The most common of these are the carbon and nitrogen cycles.

Types of Biogeochemical cycles are:

- Gaseous (e.g., nitrogen, carbon cycle): the reservoir for the gaseous type of nutrient cycle exists in the atmosphere.
- Sedimentary (e.g., sulphur and phosphorus cycle): the reservoir for the sedimentary cycle, the reservoir is located in Earth's crust.

50. Correct Answer: (d)

- Burning fossil fuels, application of nitrogen-based fertilizers, and other activities can dramatically increase the amount of biologically available nitrogen in an ecosystem.

The main sources of nitrogen in the atmosphere therefore include:

- Atmospheric precipitation,
- Geological sources,
- Agricultural land,
- Livestock (ruminants like cows, sheep, goats etc) and poultry operations and
- Urban waste

Hence option (d) is the correct answer.

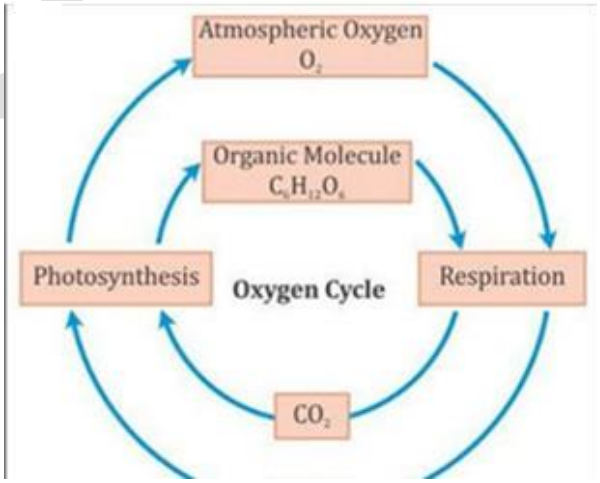
51. Correct Answer: (a)

Carbon cycle:

- Carbon is present in the atmosphere, mainly in the form of carbon dioxide (CO2).
- The carbon cycle involves a continuous exchange of carbon between the atmosphere and organisms.

We can classify the carbon cycle in two:

- Short term cycle: Carbon from the atmosphere moves to green plants by the process of photosynthesis, and then to animals.
- By process of respiration and decomposition of dead organic matter, it returns to the atmosphere. It is usually a short term cycle
- Long term cycle: Some carbon also enters a long-term cycle. It accumulates as un-decomposed organic matter in the peaty layers of marshy soil or as insoluble carbonates in bottom sediments of aquatic systems which take a long time to be released.



52. Correct Answer: (d)

- The greenhouse effect is a natural process that warms the Earth's surface. When the Sun's energy reaches the Earth's atmosphere, some of it is reflected back to space and the rest is absorbed and reradiated by greenhouse gases. Earth is surrounded by a blanket of air called the atmosphere.

- Greenhouse gas molecules in the atmosphere trap heat as they are transparent to sunlight but not to heat radiation. If the amount of carbon dioxide crosses the delicate proportion of 0.03 percent, the natural greenhouse balance may get disturbed. Carbon dioxide is a major contributor to global warming.
- Besides carbon dioxide, other greenhouse gases are methane, water vapour, nitrous oxide, and ozone. Methane is produced naturally when vegetation is burnt, digested, or rotted in the absence of oxygen.
- Large amounts of methane are released in paddy fields, coal mines, rotting garbage dumps, and by fossil fuels. Chlorofluorocarbons (CFCs) are man-made industrial chemicals used in air conditioning etc. CFCs are also damaging the ozone layer.
- Nitrous oxide occurs naturally in the environment. In recent years, their quantities have increased significantly due to the use of chemical fertilizers and the burning of fossil fuels.
- Hence option (d) is the correct answer.

53. Correct Answer: (d)

Nitrogen Cycle

- Nitrogen is a main constituent of the atmosphere encompassing about 75% of the atmospheric gases.
- It is also a vital constituent of different organic compounds such as vitamins, nucleic acids, pigments, amino acids, and proteins.
- Although nitrogen is abundant in the atmosphere, nitrogen in this form cannot be used by most living organisms to synthesise organic compounds.
- Plants and phytoplankton are not equipped to incorporate nitrogen from the atmosphere.
- Hence, nitrogen must first undergo fixation and be converted into ammonia by certain types of bacteria.

Fixation

- Fixation is the primary step in the process of converting nitrogen, usable by plants. Normally, bacteria change nitrogen into ammonium.

Nitrification

- This is the process by which ammonium is converted into nitrates by bacteria.
- The plants absorb these Nitrates.

54. Correct Answer: (c)

- Ground level or tropospheric ozone is created by chemical reactions between oxides of nitrogen (NOx gases) and volatile organic compounds (VOCs). Ozone in the troposphere is considered a greenhouse gas and contributes to global warming. It is also a common constituent of Photochemical smog. Hence statement 1 is correct.
- The upper stratosphere consists of a considerable amount of ozone (O3), which protects us from the harmful ultraviolet (UV) radiations coming from the sun. These radiations cause skin cancer (melanoma) in humans. Therefore, it is important to maintain the ozone shield. Ozone in the stratosphere is a product of UV radiations acting on dioxygen (O2) molecules. The UV radiations split apart molecular oxygen into free oxygen (O) atoms. These

oxygen atoms combine with molecular oxygen to form ozone. Hence statement 2 is correct.

- Ozone is thermodynamically less stable than oxygen and decomposes into molecular resulting in the liberation of heat. Ozone consists of three molecules of oxygen and is thus in an unstable state. So in order to get stable, it gives up one molecule of oxygen to restore the diatomic state. Thus, a dynamic equilibrium exists between the production and decomposition of ozone molecules. In recent years, there have been reports of the depletion of this protective ozone layer because of the presence of certain chemicals in the stratosphere. The main reason for ozone layer depletion is believed to be the release of chlorofluorocarbon compounds (CFCs), also known as freons. Hence statement 3 is not correct.

55. Correct Answer: (a)

Sulphur Cycle

- Sulphur (S), the tenth most abundant element in the universe, is a brittle, yellow, tasteless, and odourless non-metallic element. It comprises many vitamins, proteins, and hormones that play critical roles in both climates and in the health of various ecosystems.
- Sulphur is deposited on land as precipitation, fallout, and rock weathering, and reintroduced when organisms decompose.

On land, sulphur is deposited in four major ways:

1. Precipitation,
2. Direct fallout from the atmosphere,
3. Rock weathering, and
4. Decomposition of organic materials.

- Atmospheric sulphur is found in the form of sulphur dioxide (SO_2).
- As rain falls through the atmosphere, sulphur is dissolved in the form of weak sulphuric acid, creating acid rain.
- Sulphur can also fall directly from the atmosphere in a process called fallout.
- There are several natural sources such as volcanic eruption, evaporation of water and breakdown of organic matter in swamps that release sulphur directly into the atmosphere.

56. Correct Answer: (a)

- Intraspecific interaction in population ecology involves members of the same species interacting with each other. Various types include:

Colonization:

- Colonization is the occupation of habitat or territory by a biological community or of an ecological niche by a single population of a species. Colonial life is exhibited by animals demonstrate shades of mutualism and commensalism.
- Colonisation results in collective efforts in gathering food and a greater chance of fertilization during the reproductive phase. Hence option 2 is correct.

Aggregation:

- It refers to concentrations of animals in large numbers larger than found in a normal distribution.
- Aggregation is advantageous due to its group survival value.
- Social life exhibited by tent caterpillars is an example of temporary aggregation. Hence option 1 is correct.

Social Organization:

- Termites, ants, bees etc., are highly evolved insects that show division of labour among the individuals in a population is an important mechanism to regulate population density for certain animals.
- Proto-cooperation is an interaction between organisms of different species (interspecies) in which both organisms benefit, but neither is dependent on the relationship. Hence option 3 is not correct.

- Symbiosis is an ecological relationship between two species (interspecies) that live in close proximity to each other. Hence option 4 is not correct.

57. Correct Answer: (a)

There are lot of factors responsible for the depletion of resources:

- Overuse or irrational use: Due to unprecedented increase in human population and the industrial advancement, various natural resources are overused or overexploited.
- Non-equitable distribution of resources: Since natural resources are not distributed equitably across the planet, it led to exploitation of resources at places concentrated with one particular resource, for example coal reserves in Jharkhand and Odisha, petroleum in middle-east countries.
- Technological and industrial development: Due ever expanding technology and industrial revolution, the need of various resources such as coal, minerals etc have increased rapidly which led to increased mining and faster depletion of resources.
- Overpopulation: The population explosion has put a severe strain on the natural resources. Both renewable and non-renewable resources are under pressure. In order to satisfy the ever-increasing demands for food, water, clothing and shelter, man has exploited natural resources to such an extent that it has caused ecological imbalance in nature.
- Hence option (a) is the correct answer.

58. Correct Answer: (c)

- Decomposition is the first stage in the recycling of nutrients that have been used by an organism (plant or animal) to build its body. It is the process whereby the dead tissues break down and are converted into simpler organic forms.
- The rate of decomposition is regulated by climatic factors like temperature and soil moisture as well as by the chemical quality of detritus. These factors limit the rate of decomposition through their regulatory effect on the activities of soil microbes.

Temperature and Soil moisture:

- Organic waste matter decomposes rapidly at high temperatures and moist conditions of humid tropical regions. Within a few weeks or months, complete decomposition occurs. However, low temperature sharply reduces the decomposition rate even if the moisture content of the soil is high. Hence option 1 is correct and option 2 is not correct.

Chemical quality of the Detritus:

- The chemical quality of detritus is determined by the relative proportions of water-soluble substances like sugars, polyphenols, lignin and nitrogen. Within the same climatic conditions, the decomposition rate is high when detritus is rich in nitrogen and has low amounts of lignin. High quantities of lignin and chitin lower the rate of decomposition. Hence, option 3 is correct.

59. Correct Answer: (c)

- Biogas refers to a gas produced by the biological breakdown of organic matter in the absence of oxygen. Hence statement 1 is not correct.
- Biogas is produced by the anaerobic digestion or fermentation of biodegradable materials such as biomass, manure or sewage, municipal waste, green waste and energy crops. This type of biogas comprises methane and carbon dioxiode. The other type is wood gas which is created by gasification of wood or other biomass.
- Biogas is primarily composed of methane gas, carbon dioxide, and trace amounts of nitrogen, hydrogen, and carbon monoxide. Hence statement 2 is correct. Gobar gas is produced from the anaerobic digestion of manure.

Importance of Biogas:

- The products of biogas plant, methane gas is used as fuel and liquid humus as natural fertilizer.
- Biogas can be generated from locally available materials like animal dung, agricultural waste etc.
- It is a clean fuel.
- It has high calorific value. Hence statement 3 is not correct.

60. Correct Answer: (d)

- Pair 1 is not correctly matched. Wastewater including sewage contains many disease-causing pathogens. Polluted water (and not Arsenic) can cause many diseases like cholera, typhoid, diarrhea, dysentery, polio, and jaundice. Cholera is an acute diarrheal illness caused by infection of the intestine with Vibrio Cholerae bacteria
- Pair 2 is not correctly matched. Pollution by heavy metal cadmium caused the Itai-Itai disease in Japan.
- Pair 3 is not correctly matched. Mercury dumped into water is transformed into water-soluble methyl mercury by bacterial action. This methyl mercury accumulates in the fish. Minamata disease was caused on a large scale due to the consumption of this methyl mercury-contaminated fish.

61. Correct Answer: (b)

- Desert locusts are known for causing massive destruction of food crops, greenery, and plants. They reproduce in lakhs and form swarms in search of food. They travel hundreds of miles with their strong wings and legs without taking any break. According to FAO, a one square kilometer swarm of locusts, with about 40 million locusts, can in a day eat as much food as 35,000 people, assuming that each individual consumes 2.3 kg of food per day. Hence only option 2 is not correct
- Praying mantises prey and eat any living organism they can successfully capture and devour. But insects may be herbivores, neutrals and carnivores form the main diet.
- They eat beetles, weevils, bugs, moths, butterflies, and various insects available in our crops. Thus they act as natural pesticides for controlling the various leaf-eating loopers and semi-loopers, fruit-eating bollworms, leaf folders, and stem borers, bugs including notorious mealybug, weevils like a grey weevil, and beetles like chefer, brown flower beetle, and insect pests like jassids, aphids, hoppers.
- Chalcid Wasps are insects within the superfamily Chalcidoidea, part of the order Hymenoptera. The superfamily contains some 22,500 known species, and an estimated total diversity of more than 500,000 species, meaning the vast majority have yet to be discovered and described. Generally beneficial to humans as a group, chalcidoids help keep various crop pests under control, and many species have been imported as bio-control agents.
- Soldier beetles are a common outdoor insect that can be abundant in accidental invaders as either larvae or adults. Soldier beetles are nicknamed leather wings because of their soft, cloth like wing covers, which when brightly coloured are reminiscent of uniforms. The soldier beetle life cycle begins as a larva that hatches from an egg in the fall. These larvas are predators and will eat the eggs of many garden pests, as well as damaging larvae and soft insect bodies. They then hibernate in the soil or among fallen leaves until spring.
- Hence option (b) is the correct answer

62. Correct Answer: (d)

- The forest cover has a great value for mankind ensuring economic development, preserving environmental quality and maintaining the basic needs of the rural population. The depletion of the forest cover can have serious implications:

- Soil erosion due to reduction of vegetational cover.
- Reduction in the oxygen liberated by plants through photosynthesis.
- Habitat destruction of wild animals.
- Increase in pollution due to burning of wood as fuel and due to reduction in carbon dioxide fixation by plants.
- Decrease in availability of forest products
- Loss of cultural diversity
- Loss of biodiversity.
- Lowering of the water table due to more run-off and thereby increased use of the underground water leading to increased frequency of droughts.
- Scarcity of forest products and deterioration in economy of people residing near forests.
- Rise in carbon dioxide level results in increased thermal level of earth which in turn results in melting of ice caps and glaciers and consequent flooding of coastal areas.
- Hence, option (d) is the correct answer.

63. Correct Answer: (c)

- Coral reefs are often called the "rainforests of the sea" for their astounding richness of life. Due to their structural complexity, corals are one of the most productive ecosystems on Earth, providing important services to mankind including fisheries, coastal protection, medicines, recreation, and tourism.
- Corals are tiny animals that live in colonies and derive nourishment and energy from a symbiotic relationship with zooxanthellae algae. Coral reefs are formed over the course of thousands of years as limestone skeletons constructed by corals accumulate and form a structural base for living corals.
- Scientists estimate reefs provide a home for millions of species - from brightly coloured tropical fish to sea cucumbers which produce anti-cancer compounds. The formation of highly consolidated reefs only occurs where the temperature does not fall below 18°C for extended periods of time. The water must also be clear to permit high light penetration. The corals' requirement for high light also explains why most reef building species are restricted to the euphotic (light penetration) zone, approximately 70 m. In light of such stringent environmental restrictions, reefs generally are confined to tropical and semitropical waters.
- The diversity of reef corals, i.e., the number of species, decreases in higher latitudes up to about 25° north and south, beyond which reef corals are usually not found. Bermuda, at 32° north latitude, is an exception to this rule because it lies directly in the path of the Gulf Stream's warming waters.
- Hence option (c) is the correct answer

64. Correct Answer: (c)

- Option 1 is correct. A Sanitary landfill is a way of disposing of refuse on land without creating a nuisance to public health. Here the waste is dumped in a site and covered with earth to prevent rodents or insects from entering into it. The waste is then subjected to bacterial decomposition.
- Option 2 is not correct. An increase in the use of pesticides is harmful to the soil and leads to soil pollution. Instead, biological methods of pest control can be used to decrease the need for pesticides.
- Option 3 is correct. Composting waste is an aerobic method of decomposing solid wastes. It involves the decomposition of waste into humus called compost which acts as a good fertilizer for plants. The microorganisms help to stabilize the organic matter. Example Fungi starts working in the first week after dumping the material. Actinomycetes help in the last stages of the breakdown. Bacteria is present all throughout the process. It involves the decomposition of waste into humus called compost which acts as a good fertilizer for plants.

65. Correct Answer: (d)

- Desert plants have had to develop different ways of capturing water in order to survive in their habitat. These changes are called adaptation.
- A common adaptation to store water in the roots, stems, leaves or fruit. Plants that store water in this way are called succulents, one of which is the cactus.
- Some plants have developed very long roots that go deep into the ground to reach underground water.
- Others have developed spreading root systems lying just below the surface and stretching widely. This gives the plant many tiny roots that capture water when it rains. Hence option 2 is correct.
- Another desert adaptation is seen in the leaves. Desert plants limit water loss through their surface leaves by the size or texture of their leaves.
- Small or spiny leaves limit the surface area exposed to the drying heat. Glossy leaves reflect the sun's rays, reducing leaf temperatures. Waxy leaves prevent moisture from escaping. Hence option 1 is correct.
- In order to survive, desert animals have developed a number of ways of adapting to their habitat. The most common adaptation in behaviour is staying in the shade of plants or rocks or by burrowing underground in the heat of the day. Many desert animals are nocturnal i.e., they stay inactive in shelter during the day and hunt at night when it is cool.
- Fat increases body heat, so some desert animals have concentrated the body's fat in one place, such as a hump or tail, rather than having it all through the body. Hence option 3 is correct.
- The absence of sweat glands and the concentration of urine are other physical adaptations made by desert animals. Hence, statement 4 is not correct.

66. Correct Answer: (d)

- Genetic diversity refers to the diversity (or genetic variability) within a single species. Each individual species possesses genes that are the source of its own unique features: In human beings, for example, the huge variety of people's faces reflects each person's genetic individuality. The term genetic diversity also covers distinct populations of a single species, such as the thousands of breeds of different dogs or the numerous variety of roses. Hence statement 1 is not correct.
- Human beings genetically belong to the homo sapiens group and also differ in their characteristics such as height, colour, physical appearance, etc., considerably. This is due to genetic diversity
- The huge variety of different gene sets define an individual or a whole population's ability to tolerate stress from any given environmental factor. Genetic Diversity is also important with respect to the adaptability of species to varied environments with special reference to changing climatic conditions. So higher is the Genetic diversity greater are the chances of adapting to the Environmental changes and thus more confirmed is the survival of the species. Hence statement 2 is not correct.

67. Correct Answer: (d)

- Eutrophication is a process of depletion of oxygen from water bodies occurring either naturally or due to human activities.
- The process of eutrophication takes place due to introduction of nutrients and chemicals through discharge of domestic sewage, industrial effluents and fertilizers from agricultural field.
- The excessive growth (or bloom) of algae and plankton in a water body are indicators of this process.
- Hence option (d) is the correct answer.

68. Correct Answer: (c)

- Ecology is the study of the interactions between organisms and their environment. A number of concepts have been proposed by different ecologists to explain such interactions such as:

Allen's rule

- In endothermic animals from cold climates tend to have shorter ears, tail & leg in colder parts than in the warmer parts; thus reducing their surface to volume ratio. Hence, option (c) is the correct answer.

Bergman's rule

- It explains the effect of temperature on the absolute size of an animal. The birds & mammals of colder areas are larger in size as compared to their equivalents in a warmer area, again to reduce their surface area to volume ratio.
- Polar bears, for example, are much larger than bears which live closer to the equator.

Gause's Hypothesis/ Exclusion Principle

- It states that if two species have almost completely overlapping niches they cannot continue to coexist. One of the two species will outcompete the other and persist. The other will go locally extinct.

Gloger's rule

- In warm, humid climates animals bear dark pigmentation than those found in cool & dry climates.
- It explains the formation of narrow wings in colder regions & boarder wings in warmer regions.

Jordon's rule

- Fishes inhabiting water of low temperature tend to have more vertebrae than those of warmer water.
- Fish size, as well as the number of vertebrae, increase in colder areas compared to warmer areas.

Lindeman's Law of Trophic Efficiency

- While transferring organic food from one trophic level to the next about 10% of the organic matter is stored as flesh, the remaining is lost during transfer or broken down in respiration.

69. Correct Answer: (a)

- Eutrophication is the process in which a water body becomes overly enriched with nutrients, leading to the plentiful growth of simple plant life. The excessive growth (or bloom) of algae and plankton in a water body are indicators of this process. Eutrophication is considered to be a serious environmental concern since it often results in the deterioration of water quality and the depletion of dissolved oxygen in water bodies. Eutrophic waters can eventually become "dead zones" that are incapable of supporting life.

Chemical pollutants in water and Eutrophication process:

- As water is an excellent solvent, water-soluble inorganic chemicals that include heavy metals such as cadmium, mercury, nickel, etc constitute an important class of pollutants. Organic chemicals are another group of substances that are found in polluted water.
- Petroleum products pollute many sources of water e.g., major oil spills in oceans. Other organic substances with serious impacts are the pesticides that drift down from sprays or runoff from lands.
- Various industrial chemicals like polychlorinated biphenyls, (PCBs) which are used as cleaning solvents, detergents, and fertilizers add to the list of water pollutants. PCBs are suspected to be carcinogenic.
- Nowadays most of the detergents available are biodegradable. However, their use can create other problems. The bacteria are responsible for degrading biodegradable detergent feed on it and grow rapidly. While growing, they may use up all the oxygen dissolved in water. The

lack of oxygen kills all other forms of aquatic life such as fish and plants.

- Fertilizers contain phosphates as additives. The addition of phosphates in water enhances algae growth. Such profuse growth of algae covers the water surface and reduces the oxygen concentration in water. This leads to anaerobic conditions, commonly with the accumulation of obnoxious decay and animal death.
- Thus, bloom-infested water inhibits the growth of other living organisms in the water body. This process in which nutrient enriched water bodies support a dense plant population, which kills animal life by depriving it of oxygen and results in subsequent loss of biodiversity is known as Eutrophication.
- Hence option (a) is the correct answer.

70. Correct Answer: (d)

- Desertification is the reduction or destruction of the biological potential of the land, leading to desert like conditions.
- Lack of vegetative cover, wind and water erosion, overgrazing, slash and burn agriculture cause desertification.
- Meaningful agricultural activities are not possible on desert land. Desertification causes land degradation, making the soil infertile.
- Hence option (d) is the correct answer.

71. Correct Answer: (c)

- Acid rain, or acid deposition, is a broad term that includes any form of precipitation with acidic components, such as sulfuric or nitric acid that fall to the ground from the atmosphere in wet or dry forms.
- Normally rainwater has a pH of 5.6 due to the presence of H+ ions formed by the reaction of rainwater with carbon dioxide present in the atmosphere. When the pH of the rainwater drops below 5.6, it is called acid rain. Hence option (c) is the correct answer.
- Acid rain refers to the ways in which acid from the atmosphere is deposited on the earth's surface. Oxides of nitrogen and sulfur which are acidic in nature can be blown by the wind along with solid particles in the atmosphere and finally settle down either on the ground as dry deposition or in water, fog and snow as wet deposition.
- Acid rain is a by-product of a variety of human activities that emit the oxides of sulfur and nitrogen in the atmosphere. As mentioned earlier, the burning of fossil fuels (which contain sulfur and nitrogenous matter) such as coal and oil in power stations and furnaces or petrol and diesel in motor engines produce sulfur dioxide and nitrogen oxides.
- SO_2 and NO_2 after oxidation and reaction with water are major contributors to acid rain because polluted air usually contains particulate matter that catalyses the oxidation.
- Ammonium salts are also formed and can be seen as an atmospheric haze (aerosol of fine particles). Aerosol particles of oxides or ammonium salts in raindrops result in wet deposition. SO_2 is also absorbed directly on both solid and liquid ground surfaces and is thus deposited as dry deposition.
- Acid rain is harmful to agriculture, trees, and plants as it dissolves and washes away nutrients needed for their growth. It causes respiratory ailments in human beings and animals. When acid rain falls and flows as groundwater reaches rivers, lakes, etc. it affects plants and animal life in the aquatic ecosystem. It corrodes water pipes resulting in the leaching of heavy metals such as iron, lead, and copper into the drinking water.

72. Correct Answer: (d)

- Based on the particular kind of habitat, the natural ecosystems are further categorised into terrestrial and aquatic. Aquatic ecosystems can be either

freshwater (ponds, lakes, streams), or saltwater (marine, estuaries) types.

Freshwater ecosystems can be divided into two categories:

- A lentic ecosystem entails a body of standing water, ranging from ditches, seeps, ponds, seasonal pools, basin marshes, swamps and lakes. Deeper waters, such as lakes, may have layers of ecosystems, influenced by light. Ponds, due to their having more light penetration, are able to support a diverse range of water plants. There are also known as the Pond ecosystem. Hence, options 2 and 3 are not correct.
- A lotic ecosystem can be any kind of moving water, such as a run, creek, brook, river, spring, channel or stream. The water in a lotic ecosystem, from source to mouth, must have atmospheric gases, turbidity, longitudinal temperature gradation and material dissolved in it. Hence, options 1 and 4 are correct.

73. Correct Answer: (b)

- Human activities like deforestation and burning of fossil fuels are the major factors that have induced climatic changes and resultant effects.
- Deforestation affects the local climate of an area by reducing the evaporative cooling that takes place from both soil and plant life. Evaporation and evapo-transpiration processes from the trees and plants return large quantities of water to the atmosphere, promoting cloud formation and rains.
- Less evaporation means that more of the sun's energy is used to warm the surface and consequently, the air above, leading to a rise in temperature. Hence, the destruction of the ecosystem will result in a decline in evapotranspiration.
- Hence option 1 is not correct.
- Increasing amount of forest in removal also result decreasing amount of rainfall. Decreased rainfall reduces the percolation of water in the underground and consequently lowers the levels of the underground water table. All this leads to the drying up of rivers, streams, lakes and aquifers. Hence option 2 is correct.
- The increase in CO2, in the atmosphere and the resultant increase in temperatures also leads to increasing frequency of floods and droughts.
- Loss of vegetative cover also leads the rainwater to runoff rapidly over the surface causing floods. Floods wash away the topsoil cover, devoiding the soil of its nutrients and thereby, its fertility. Loss of soil productivity by erosion of topsoil results in the formation of deserts.
- Human activities cause the majority of threats to species, sites and habitats. Habitat destruction and land conversion for agricultural and forestry activities and associate degradation and fragmentation result in the loss of biospecies and loss of biomass. Hence option 3 is correct.

74. Correct Answer: (a)

- No species can live in isolation in a habitat and results in Interspecific interactions that arise from the interaction of populations of two different species.
- These interactions could be beneficial, detrimental, or neutral to one of the species or both. In nature, animals, plants, and microbes interact in various ways to form a biological community. Many interactive linkages exist even in minimal communities.

Species A	Species B	Name of Interaction
+	+	Mutualism
-	-	Competition
+	-	Predation
+	-	Parasitism
+	0	Commensalism
-	0	Amensalism

- + sign denotes Beneficial interactions
- - sign denotes Detrimental Interactions
- 0 denotes neutral Interactions

- Pitcher plant-eating insects is an example of Predation where Species A (Pitcher plant) is getting the benefit at the cost of species B (Insect) where Pitcher plant is predator and insect is prey.
- Plants in the evergreen forests are fighting for sunlight, which negatively affects their growth. It is an example of competitive interaction where plants are competing for the same source i.e. sunlight.
- Cattle egret and grazing cattle is an example of commensalism. The egrets always feed close to where the cattle are grazing, As they get some of their nutrition by feeding on these ticks and mites that were stirred up by the movement of cattle and grazing of grass that might be difficult for the egrets to find and catch otherwise.
- Sparrow-eating seed is an example of Predation where sparrow is getting benefited at the cost of seeds.

75. Correct Answer: (d)

- An important characteristic of all communities is that their composition and structure constantly change in response to the changing environmental conditions. This change is orderly and sequential, parallel with the changes in the physical environment. These changes lead finally to a community that is in near equilibrium with the environment and that is called a climax community.
- The gradual and fairly predictable change in the species composition of a given area is called ecological succession.
- During succession, some species colonize an area and their population becomes more numerous whereas populations of other species decline and even disappear.
- The entire sequence of communities that successively change in a given area is called sere(s). The individual transitional communities are termed seral stages or seral communities.

In the successive seral stages, the following phenomenons are observed:

- Change in the diversity of species of organisms
- Increase in the number of species
- Increase in the number of organisms
- increase in the total biomass
- Hence, option (d) is the correct answer.

76. Correct Answer: (b)

- For most of the year, the tundra biome is a cold, frozen landscape. It is a treeless polar desert. This biome has a short growing season, followed by harsh conditions that the plants and animals in the region need special adaptations to survive. Hence statement 1 is correct.
- Tundra form in two distinct cold and dry regions.
- Arctic tundra are found on high-latitude landmasses, above the Arctic Circle.
- Alpine tundra are located at very high elevations atop mountains, where overnight temperatures fall below freezing.
- Tundra regions typically get less than 25 centimeters (10 inches) of precipitation annually, which means these areas are also considered deserts.
- The soil in the Arctic is largely permafrost or soil that remains frozen year-round, leaving only a thin surface layer of thawed soil in summer for plant roots to grow in. Tundra soil is also scarce in many of the nutrients that plants need to grow. Reptiles and amphibians are few or absent because of the extremely cold temperatures. Hence statement 2 is correct.
- Most of the animals have long life. They are protected from chillness by the presence of thick cuticle and epidermal hair or fur. Mammals have a large body size and small tail and ears to avoid the loss of heat from the surface. Hence statement 3 is correct.

77. Correct Answer: (a)

- Ecological interactions are the relationships between two species in an ecosystem. These relationships can be categorized into many different classes of interactions based either on the effects or on the mechanism of the interaction.

The various types of ecological interactions are as follows:

- **Ammensalism:** Interaction where one impedes or restricts the success of the other without being positively or negatively affected by the presence of another. The bread mold Penicillium is a common example of this; penicillium secrete penicillin, a chemical that kills bacteria. A second example is the black walnut tree (Juglans nigra), which secretes juglone, a chemical that harms or kills some species of neighbouring plants from its roots.
- **Commensalism:** It occurs when one organism takes benefits by interacting with another organism by which the host organism is not affected. A good example is the pilot fish living with a shark. The shark is not affected in the process as pilot fish only eats the leftover food of the shark which does not deplete the shark's resources.
- **Neutralism:** It is the relationship between two species which do interact but do not affect each other. It is to describe interactions where the fitness of one species has absolutely no effect whatsoever on that of another. True neutralism is extremely unlikely and impossible to prove.
- **Competition:** It is an interaction between individuals or populations that is mutually detrimental.
- Predation: Interaction between organisms in which one organism captures biomass from another.
- Mutualism: It is an interaction between two or more species, where species derive a mutual benefit. Examples include cleaner fish, pollination and seed dispersal, gut flora and nitrogen fixation by fungi.

78. Correct Answer: (d)

- India currently has 46 sites designated as Wetlands of International Importance (Ramsar Sites), with a surface area of 1,083,322 hectares. Some of the Ramsar Sites are human-made wetlands.

These include:

- Pong Dam Lake in Himachal Pradesh is a water storage reservoir created in 1975 on the Beas River in the low foothills of the Himalaya on the northern edge of the Indo-Gangetic plain. The avian habitats formed by the creation of the Pong Dam assume a great significance" - given the site's location on the trans-Himalayan flyway, more than 220 bird species have been identified, with 54 species of waterfowl.
- Nandur Madhameshwar is a mosaic of lakes, marshes and riparian forest on the Deccan Plateau. Construction of the Nandur Madhameshwar Weir at the confluence of the Godavari and Kadwa Rivers helped create a thriving wetland. It was originally designed to overcome water shortages in the surrounding area.
- The Site now also serves as a buffer against floodwaters and as a biodiversity hotspot. With 536 species recorded, its diverse habitats contrast with the surrounding semi-arid conditions caused by the rain shadow of the Western Ghats mountain range.
- The Site hosts some of India’s most iconic species, such as the leopard and Indian sandalwood (Santalum album). It also provides sanctuary to critically endangered species including Deolali minnow etc.
- Thol Lake is a shallow reservoir dominated by open water areas that was originally constructed for irrigation in 1912. In 1988, it was declared as a wildlife sanctuary to protect the birdlife found there: it is on the Central Asian Flyway and more than 320 bird species

can be found, making up some 57% of all the bird species of Gujarat. More than 110 waterbird species have been recorded, about 43% of India's waterbird species, with almost 30% of those species being migratory waterbirds.

- Hence, option (d) is the correct answer.

79. Correct Answer: (c)

- Black carbon is not a gas but a particulate — a component of soot emitted by the incomplete combustion of fossil fuels and biomass. Hence statement 1 is not correct.
- Along with methane, black carbon is one of the two greenhouse contributors the global community has targeted for immediate reduction to curb global warming before the Arctic melts.
- It stays in the atmosphere for shorter period of time and descends along with precipitation after some time. Because of black carbon's short atmospheric life span, decreasing its presence offers an opportunity to mitigate the effects of global warming quickly — within weeks. Hence statement 2 is correct.
- Control of black carbon, according to many scientists — particularly from fossil-fuel sources — could be the fastest method of slowing global warming in the near future
- Here on Earth, the albedo effect has a significant impact on our climate. correct. The albedo of a surface is the fraction of the incident sunlight that the surface reflects. The lower the albedo, the more radiation from the Sun that gets absorbed by the planet, and temperatures will rise. If the albedo is higher, and the Earth is more reflective, more of the radiation is returned to space, and the planet cools.
- Black carbon is generally thought to have both a direct warming effect (by absorbing incoming solar radiation in the atmosphere and converting it to heat radiation) and an indirect warming effect (by reducing the reflectivity (albedo) of snow and ice). Hence statement 3 is correct.

80. Correct Answer: (d)

- The Ramsar Convention is an international treaty for the conservation and sustainable utilization of wetlands, recognizing the fundamental ecological functions of wetlands and their economic, cultural, scientific, and recreational value.
- The aim of the Ramsar list is to develop and maintain an international network of wetlands which are important for the conservation of global biological diversity and for sustaining human life through the maintenance of their ecosystem components, processes and benefits. Wetlands declared as Ramsar sites are protected under strict guidelines of the convention.
- India currently has 46 sites designated as Wetlands of International Importance (Ramsar Sites), with a surface area of 1,083,322 hectares. The Ramsar list also includes 3 wetlands from the North Eastern States of India. These are Deepor Beel located about 10 km Southwest of Guwahati city is considered one of the large and important riverine wetlands in the Brahmaputra Valley of lower Assam, India. Deepor Beel has also been designated as a Ramsar Site in November 2002.
- The largest freshwater lake in Northeast India, the pristine Loktak Lake is known for its floating circular swamps, which are called phumdis in the local tongue. The lake houses the only floating national park in the world, the Keibul Lamjao National Park, which is the last refuge of the endangered brow-antlered deer or sangai, Manipur's state animal. It was also listed under the Montreux Record on 16 June 1993.
- Rudrasagar Lake, also known as Twijilikma, is a lake located in Melaghar, Tripura, India. A lowland sedimentation reservoir in the northeast hills, fed by three perennial streams discharging to the River Gomti. The Ramsar Convention has declared

Rudrasagar Lake as a wetland of international importance.

- Hence, option (d) is correct answer.

81. Correct Answer: (d)

- IAP (Indoor Air Pollution) is the degradation of indoor air quality by harmful chemicals and other materials. Indoor air quality is affected by many factors, including the type and running conditions of indoor pollution sources, ventilation conditions, as well as indoor activities.
- According to the Environment Protection Act, 1986, the levels of indoor air pollutants are often 2-5 times higher than outdoor levels. In some cases, these levels can exceed the outdoor levels of the same pollutants 100 times.
- The principal sources of indoor air pollution are Combustion, building material, and bioaerosols. While RADON, ASBESTOS, pesticides, heavy metals, volatile organic matter, and environmental tobacco smoke are considered major indoor pollutants in developed countries, the combustion products of biomass fuels contribute most to indoor air pollution in developing nations.
- In India, out of 0.2 billion people using fuel for cooking; 49% use firewood; 8.9% cow dung cake; 1.5% coal, lignite, or charcoal; 2.9% kerosene; 28.6% liquefied petroleum gas (LPG); 0.1% electricity; 0.4% biogas; and 0.5% any other means.
- The incomplete combustion products of biomass fuels include suspended particulate matter, CARBON MONOXIDE, polyaromatic hydrocarbons, poly organic matter, FORMALDEHYDE, etc., which have adverse effects on health.
- The combustion of coal results in the production of oxides of sulfur, arsenic, and fluorine. Pollutants such as aldehydes, volatile, and semi-volatile organic compounds are produced from resins, waxes, polishing materials, cosmetics, and binders.
- Lastly; biological pollutants like dust mites, molds, pollen, and infectious agents produced in stagnant water, mattresses, carpets, and humidifiers too pollute indoor air.
- Hence option (d) is the correct answer.

82. Correct Answer: (b)

- Pair 1 is not correctly matched: Located in the Himalayan foothills in western Assam, Manas was originally a game reserve since 1928 and became a Tiger Reserve in 1974, a World Heritage Site in 1985, and a Biosphere Reserve in 1989 then was declared as a National Park in 1990. The park is contiguous with the Buxa Tiger Reserve in West Bengal, and in 2003 it was declared part of the Chirang-Ripu Elephant Reserve which serves as the international corridor for elephant migration between India and Bhutan. The Manas river flows through the west of the park and is the main river within it.
- Pair 2 is correctly matched: Panna National Park is located in the Panna and Chhatarpur districts of Madhya Pradesh in India. It was declared as a National Park in the year of 1981. The park is known worldwide for its wildlife including tigers, deer, antelope, vultures, wolves, Chinkara, Cheetal and lots more. Ken River flows through this reserve and creates beautiful waterfalls on its way to the valley. The biodiversity in this national park is extremely rich.
- Pair 3 is not correctly matched: Papikonda National Park spreads over 1012.86 square kilometres in East and West Godavari districts of Andhra Pradesh. The park lies on the left and right banks of the river Godavari and cuts through the Papikonda hill range of Eastern Ghats. The River Godavari enriches Papikonda Park with its natural beauty. The majority of the area of the park is covered with moist deciduous forest and include animal species such as tigers, mouse deer, gaur etc.
- Pair 4 is not correctly matched: Silent Valley National Park is a national park in

Kerala, India. It is located in the Nilgiri hills, has a core area of 89.52 km², which is surrounded by a buffer zone of 148 km². This national park has some rare species of flora and fauna. It is a beautiful representation of the last remaining rainforest of Kerala. Silent Valley is home to the largest population of Lion-tailed macaques, an endangered of primate. Kuntipuzha River divides the park into a narrow eastern sector of width 2 kilometres and a wide western sector of 5 kilometres. The river is characterized by its crystal clear water and perennial nature.

83. Correct Answer: (c)

- The Carbon Intensity Indicator (CII) is a measure of how efficiently a ship transports goods or passengers and is given in grams of CO2 emitted per cargo-carrying capacity and nautical mile. Hence, option (c) is the correct answer.
- The ship is then given an annual rating ranging from A to E, whereby the rating thresholds will become increasingly stringent towards 2030.
- The CII applies to all cargo and cruise ships above 5,000 GT (Giga Tonne).
- The CII is based directly on fuel consumption, which is influenced by how a specific ship is operated in combination with its technical efficiency and fuel.
- Its value will be affected by the type of fuel used, the efficiency of the vessel and operational parameters such as vessel speed, cargo transported, weather conditions and the general condition of the vessel (e.g. biofouling).
- The yearly CII is calculated based on reported International Maritime Organisation (IMO) data.

84. Correct Answer: (d)

- Primary succession sere begins with lichens. Lichens and mosses are the first to colonise because they have no roots but schizoids, which fix them on barren rock and can survive without soil. Lichens can invade and colonise such areas, coming in, by various methods of dispersal and gaining a foot hold by means of their tenacious, water-seeking fungal component and thus forming the first community, very appropriately often called the pioneer community.
- Lichens are soil builders, producing weak acids that very gradually erode the rock surface. As organic products and sand particles accumulate in tiny fissures, mosses and larger plants, such as grasses also get an opportunity to establish them and begin a new seral stage. In time, lichens that made the penetration of plant roots possible are no longer able to compete for light, water and minerals and will be succeeded by larger and more nutrient demanding plants such as shrubs and trees.
- Ultimately "the final stable and self - perpetuating community which is in equilibrium with its environment", is formed and this is called climax community. The climax community is the most productive community that the environment can sustain. The animals of such a community also exhibit succession, which to a large extent is governed by the plant succession, but is also influenced by the types of animals that are able to migrate from neighbouring communities.

Difference between pioneer and climax communities:

Characteristic	Pioneer community	Climax community
Growth rate	Rapid	Slow
Life span	Short	Long
Relative number of seeds	Many	Few
Food productivity	Low	High
Biomass	Small	Large
Species diversity	Low	High
Nutrient supply in soil	Low	High

• Hence option (d) is the correct answer.

85. Correct Answer: (c)

- India has a network of 903 Protected Areas covering about 5 per cent of the total geographic area of the country. Minister for Environment, Forest and Climate Change, recently released the Management Effectiveness Evaluation (MEE) of 146 national parks and wildlife sanctuaries in the country.
- According to the survey, Tirthan Wildlife Sanctuary and Great Himalayan National Park in Himachal Pradesh have performed the best among the surveyed protected areas. The Turtle Wildlife Sanctuary in Uttar Pradesh was the worst performer in the survey.
- Located in the Kullu district, Tirthan wildlife sanctuary is one of the most magnificent sanctuaries in Himachal Pradesh. Located at a height of 5000 feet and overlooking River Tirthan, this beautiful wildlife sanctuary is one of the most amazing places of Himachal Pradesh. This sanctuary is connected to the famous national park of this area, the Great Himalayan National Park. Hence, pair 1 is not correctly matched.
- The 'Kachhua' or Turtle Wildlife Sanctuary (TWS), the world's only protected area dedicated to freshwater turtles is in Uttar Pradesh. The turtle sanctuary was set up in 1989 under the Ganga action plan. Turtles, the Ganges dolphin and other water animals can be found here. Hence, pair 3 is not correctly matched.
- Bhadra Wildlife Sanctuary is a protected area and tiger reserve as part of the Project Tiger, situated in Chikkamagaluru district, 23 km south of Bhadravathi city, 38 km 20 km from Tarikere town, northwest of Chikkamagaluru and 283 km from Bengaluru city in Karnataka state, India. Hence, pair 2 is correctly matched.

86. Correct Answer: (d)

- Peatlands are a type of wetlands that occur in almost every country on Earth, currently covering 3% of the global land surface. The term 'peatland' refers to the peat soil and the wetland habitat growing on its surface.
- In these areas, year-round waterlogged conditions slow the process of plant decomposition to such an extent that dead plants accumulate to form peat.
- Peatland landscapes are varied – from blanket bog landscapes with open, treeless vegetation.
- Large amounts of carbon, fixed from the atmosphere into plant tissues through photosynthesis, are locked away in peat soils, representing a valuable global carbon store. At the same time, peatlands are the largest natural terrestrial carbon store. Hence statement 1 is correct.
- Draining peatlands reduces the quality of drinking water due to pollution from dissolved compounds. Damage to peatlands also results in biodiversity loss. For example, the decline of the Bornean Orangutan population by 60% within a sixty-year period is largely attributed to the loss of its peat swamp habitat. Peatlands are also a natural form of water purification and flood protection. Acting as a huge sponge, peatlands soak up and retain water in the landscape, holding back potentially dangerous flood waters. When peatlands do release water it is cleaner because peat acts as a filter. Hence statement 2 is correct.
- A bog is a freshwater wetland of soft, spongy ground consisting mainly of partially decayed plant matter called peat. Bogs are generally found in cool, northern climates. Hence statement 3 is correct.

87. Correct Answer: (b)

- The cold deserts of the Himalayas are dotted with the bright red berries of the seabuckthorn plant, popularly known as Leh berries. It is also referred to as sandthorn, sallowthorn, or seaberry. It produces orange-yellow berries, which have been used over centuries as food, traditional medicine, and skin treatment in Mongolia, Russia, Ukraine, and northern

Europe, which are its origin regions. Hence statement 1 is not correct.

- The Ministry of Environment and Forests and the Defence Research and Development Organisation have launched a major national initiative for seabuckthorn cultivation in the high-altitude, cold desert ecosystems.
- The Seabuckthorn, also called the "Wonder plant" and "Ladakh gold" has multi-purpose medicinal and nutritional properties, and also helps in soil conservation and nitrogen fixation. Hence statement 2 is correct.
- Hardy, drought-resistant and tolerant to extreme temperatures from – 43º C to + 40º C, the plant has an extensive root system which can fix atmospheric nitrogen, making it ideal for controlling soil erosion and preventing desertification.
- The seabuckthorn is the only fruit which contains all types of Omega acids (Omega 3, 6 and 9) as well as the rare Omega 7.
- Long considered a humble shrub of the Himalayas, every part of the plant – fruit, leaf, twig, root and thorn – has been traditionally used for medicine, nutritional supplements, fuel and fencing.

88. Correct Answer: (b)

- Biodiversity, abbreviated from the terms 'biological' and 'diversity', encompasses the variety of life forms found at all scales of biological organisation, ranging from genes to species to ecosystems.
- The greatest biodiversity is found in the tropical regions of the world, particularly among tropical rainforests and coral reefs.
- Biodiversity is increased by genetic change and evolutionary processes and reduced by habitat destruction, population decline and extinction.
- Genetic Diversity is the diversity of genetic characteristics (expressed or recessive) within a species (i.e. between individuals and populations of the same species).
- This component of biodiversity is important because it allows populations to adapt to environmental changes through the survival and reproduction of individuals within a population that have particular genetic characteristics that enable them to withstand these changes.
- Species Diversity is simply the number and relative abundance of species found in a given biological organisation (population, ecosystem, Earth).
- Species are the basic units of biological classification and hence, this is the measure most commonly associated with the term 'biodiversity'. Hence option (b) is the correct answer.
- Ecosystem Diversity can be defined as the variety of different habitats, communities and ecological processes.
- A biological community is defined by the species that occupy a particular area and the interactions between those species. A biological community together with its associated physical environment is termed an ecosystem.

89. Correct Answer: (d)

- The mountainous region of the western and eastern Himalayas is the habitat of Snow leopards in India. They are primarily found in the states of Jammu & Kashmir, Himachal Pradesh, Uttarakhand, Sikkim and Arunachal Pradesh.
- Rocky outcrops and ravines provide a perfect habitat for snow leopards to conceal themselves and sneak up on the prey. Their beautiful silvery fur marked with black spots helps them camouflage against the snowline and rocks of the mountain.
- Until 2017 the snow leopard was listed as an endangered species on the IUCN Red List. However, in 2017 the species' status was changed to vulnerable. There are about 450-500 snow leopards in the Indian forests.

Some of the important national parks where one can find snow leopards are:

- Hemis National Park is the largest national park in India spanning an area of 4,400 sq km. It is also known to be the largest

national park in South Asia. The park supports a viable breeding population of about 200 snow leopards.

- Dachigam National Park is located 22 km away from the Jammu & Kashmir state capital of Srinagar. The park hosts several species of mammals including the large cat – snow leopard, Kashmir stag, hill fox, Himalayan serow and Himalayan black bear.
- The Great Himalayan National Park is spread across 4 valleys namely, Jiwa Nal valley, Sainj Valley, Tirthan Valley and Parvati Valley. UNESCO declared it as a 'World Heritage Site' in the year 2014. This park is one of the best places to spot the exquisite snow leopards in India.
- Gangotri National Park is a national park in Uttarkashi District of Uttarakhand in India. Established in 1989, this high-altitude wildlife sanctuary protects indigenous fauna and fauna. Various endangered species like bharal or blue sheep, black bear, brown bear, Himalayan Monal, Himalayan snowcock, Himalayan thar, musk deer and snow leopard are found in the park. It is also a bird-watching zone.
- Govind Pashu National Park s located in the Uttarkashi district of Uttarakhand and is named after a prominent Indian freedom fighter Govind Ballabh Pant. The Indian Government started the 'Snow Leopard Project' from this park.
- Hence option (d) is the correct answer.

90. Correct Answer: (c)

- Speciation is how a new kind of plant or animal species is created.
- There are five types of speciation: allopatric, peripatric, parapatric, and sympatric and artificial.

Allopatric speciation:

- It occurs when a species separates into two separate groups which are isolated from one another. A physical barrier, such as a mountain range or a waterway, makes it impossible for them to breed with one another. Each species develops differently based on the demands of their unique habitat or the genetic characteristics of the group that are passed on to offspring. Hence option (c) is the correct answer.

Peripatric speciation:

- When small groups of individuals break off from the larger group and form a new species, this is called peripatric speciation. The main difference between allopatric speciation and peripatric speciation is that in peripatric speciation, one group is much smaller than the other. Unique characteristics of the smaller groups are passed on to future generations of the group, making those traits more common among that group and distinguishing them from the others.

Parapatric speciation:

- In parapatric speciation, a species is spread out over a large geographic area. Although it is possible for any member of the species to mate with another member, individuals only mate with those in their own geographic region. Like allopatric and peripatric speciation, different habitats influence the development of different species in parapatric speciation. Instead of being separated by a physical barrier, the species are separated by differences in the same environment.

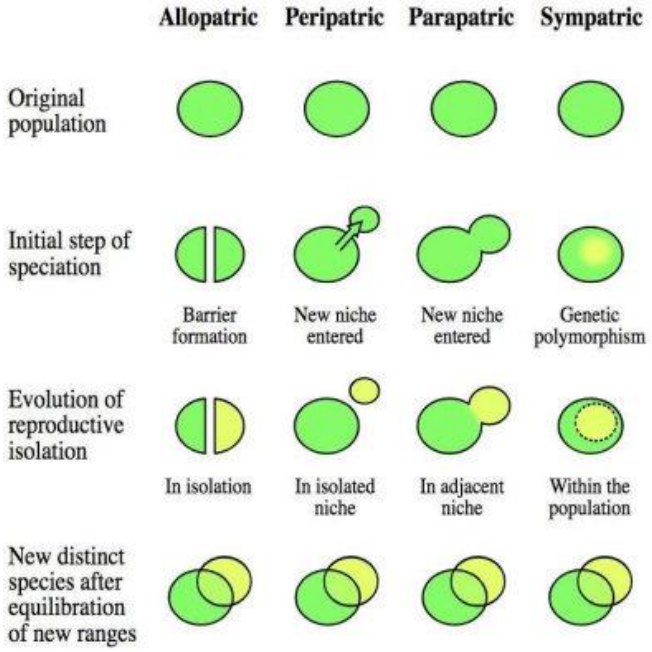
Sympatric Speciation:

- Sympatric speciation is controversial. Some scientists don't believe it exists.
- It occurs when there are no physical barriers preventing any members of a species from mating with another, and all members are in close proximity to one another.
- A new species, perhaps based on a different food source or characteristic, seems to develop spontaneously. The theory is that some individuals become

dependent on certain aspects of an environment—such as shelter or food sources—while others do not.

Artificial Speciation:

- Artificial speciation is the creation of new species by people. This is achieved through lab experiments, where scientists mostly research insects like fruit flies.



91. Correct Answer: (c)

- Jerdon's Courser is a nocturnal cursorial bird found only in the State of Andhra Pradesh, India. It is one of the world's rarest bird species and is classified as Critically Endangered (CR) by the International Union for Conservation of Nature (IUCN). The species was believed to be extinct until it was rediscovered in 1986 near Cuddapah District of Andhra Pradesh. The site where it was rediscovered was designated as the Sri Lankamaleswara Wildlife Sanctuary. Hence, pair 1 is not correctly matched.
- The Black-necked Crane is a medium-sized crane in Asia that breeds on the Tibetan Plateau and remote parts of India and Bhutan. This species is found in India, China and Bhutan and breeds in high altitude wetlands in the Tibetan plateau at elevations of 2950-4900 m above mean sea level. High altitude marshes and lakes of the Tibetan Plateau (Tibet, Qinghai, Xinjiang, Gansu), Sichuan (China), and eastern Ladakh (India) are the known breeding grounds of black-necked cranes. In India, the black-necked crane is found in eastern Ladakh. Recently, the Ladakh Union Territory administration has announced a black-necked crane as its state bird. Hence, pair 2 is correctly matched.
- Great Indian bustard, a large bird of the bustard family, one of the heaviest flying birds in the world. The great Indian bustard inhabits dry grasslands and scrublands on the Indian subcontinent. Historically, the great Indian bustard was distributed throughout Western India, spanning 11 states, as well as parts of Pakistan. Its stronghold was once the Thar desert in the northwest and the Deccan plateau of the peninsula. Today, its population is confined mostly to Rajasthan and Gujarat. Its largest populations are found in the Indian state of Rajasthan. Hence, pair 3 is correctly matched.

92. Correct Answer: (c)

- Mangrove are salt tolerant evergreen forest ecosystem found mainly in the tropical and subtropical inter-tidal regions of the world between approximately 32° N and 38° S latitude and total mangrove cover has been estimated to be approximately 15.6 million hectares globally. Hence statement 1 is correct.
- They provide potential contributions in ecological services, provides habitat for many terrestrial and marine species, various food resources, shelter and site for fertilization for variety of aquatic fauna resulting into rich biodiversity.
- Mangroves distribution and abundance in intertidal areas could be considered as a direct indicator of the habitat health of the coastal ecosystem and they are highly sensitive to environmental change.
- Mangroves exhibit Viviparity mode of reproduction i.e. seeds germinates in the tree itself (before falling to the ground).

This is an adoptive mechanism to overcome the problem of germination in saline water. Hence statement 2 is not correct.

- It produces pneumatophores (blind roots) to overcome respiration problem in the anaerobic soil conditions. Some mangroves secrete excess salt through their leaves.
- How mangroves deal with excess salt: In species from the genera Rhizophora (the red mangrove) and Bruguiera, the plants create a barrier and can almost completely exclude the salt from entering their vascular system—over 90 percent of the salt from seawater is excluded.
- For many mangroves, the salt is dealt with after it enters the plant. Mangroves categorized as secretors, including species in the black mangrove genus Avicennia, push salt from the ocean water out through special pores or salt glands within their leaves. As the salty water evaporates, noticeable salt crystals often form on the surface of the leaves.
- The leaves of some mangrove can also store unwanted salt. Since leaf cells can hold a large volume of water when compared to all other cells, salt is drawn to the leaves as a mechanism to balance the salt concentration. As the leaves age, the cells grow in size since more water is needed to dilute the accumulating salt. This hoarding of water creates thick and fleshy leaves, a characteristic called succulence. Eventually, the leaves age and fall off the tree, taking the salt with them. Hence statement 3 is not correct.

93. Correct Answer: (a)

- Indian Elephant (EN) is listed in Schedule I of the Indian Wildlife (Protection) Act, 1972, CITES Appendix I and CMS Appendix I and Convention on the Conservation of Migratory Species of Wild Animals (CMS COP13). It aims:
- To protect Elephants and their habitat Government of India launched Project Elephant that is a Central Government sponsored conservation scheme launched in 1992.
- To protect elephant corridors and habitats
- To mitigate and prevent human-elephant conflict.
- The government also provides technical and financial help to the elephant range states in the protection and management of elephant corridors and elephant habitats declared by the states.
- Mayurjharna Elephant Reserve is located in the areas of Midnapore, Bankura, and Purulia District of West Bengal. It is contiguous with the Singhbhum Elephant Reserve of Jharkhand State on the west and the Mayurbhanj Elephant Reserve of Odisha on the east. Hence pair 1 is correctly matched.
- Baitami or (Brahmani-Baitarani) Elephant Reserve is located in Odisha. It covers the portions of Keonjhar, Sundargarh, Angul and Dhenkanal districts. Hence pair 2 is correctly matched.
- Lemru Elephant Reserve is located in Chhattisgarh. It was declared as Elephant Reserve in 2019 to preserve the Hasdeo Arand forest (has high-quality coal reserves) and covers the portions of Surguja, Korba, Jashpur and Raigarh districts in Northern Chhattisgarh. The reserve is a refugee for elephants migrating from Jharkhand where open cast mining is rampant. Hence pair 3 is not correctly matched.
- Mahanadi Elephant Reserve is also located in the state of Odisha and consists of Satkosia Tiger Reserve and its adjoining wildlife sanctuaries i.e. Satkosia Gorge Wild Life Sanctuary and Baisipalli Wild Life Sanctuary. Hence pair 4 is not correctly matched.

94. Correct Answer: (c)

- Habitat is the physical environment in which an organism lives (address of an organism). Many habitats can make up an ecosystem. Hence statement 1 is correct.
- The habitat is a defined place or area of the environment according to the

requirements of a particular life form. Therefore, a habitat is always an environment, but an environment is not always a habitat.

- A habitat always has life in it, whereas the environment does not necessarily have life in it. A habitat is always a preference of one species, whereas an environment could be a preference of many species that could eventually become many habitats.
- Usually, the environment governs the properties of a habitat, but not vice versa.
- A single habitat may be common for more than one organism which have similar requirements.
- For example, a single aquatic habitat may support a fish, frog, crab, phytoplankton and many others.
- The various species sharing a habitat thus have the same 'address'. E.g. Forest, river etc.
- There is no natural habitat on earth that is inhabited only by a single species and such a situation is even inconceivable. For any species, the minimal requirement is one more species on which it can feed.
- Even a plant species, which makes its own food, cannot survive alone; it needs soil microbes to break down the organic matter in soil and return the inorganic nutrients for absorption. Hence statement 2 is correct.

95. Correct Answer: (c)

- All the life on earth along with biological variety in all its forms, from the genetic makeup of plants and animals to cultural diversity encompasses biodiversity.
- It is mainly measured by the components such as species richness and species evenness. Species richness is measure of number of species found in a community whereas species evenness measure the proportion of species on a given site. Species richness is usually measured by Alpha diversity, Beta diversity, Gama diversity
- Statement 1 is correct: Alpha diversity refers to the diversity within a particular area or ecosystem and is usually express in number of species. So it will represent the species diversity present within each forest or grassland patch of the slope.
- Statement 2 is correct: Beta diversity is a comparison of diversity between the ecosystems and different communities, usually measured as change in amount of species. It will scale the species diversity between any two patches and their communities.
- Gamma diversity is a measure of overall diversity for different ecosystem within a region and scale species diversity along the entire range of the mountain slope.

96. Correct Answer: (c)

- Most reef-building corals contain photosynthetic algae, called zooxanthellae, that live in their tissues. The coral provides the algae with a protected environment and compounds they need for photosynthesis. In return, the algae produce oxygen and help the coral to remove wastes.
- Most importantly, zooxanthellae supply the coral with glucose, glycerol, and amino acids, which are the products of photosynthesis. The coral uses these products to make proteins, fats, and carbohydrates, and produce calcium carbonate.
- This symbiotic relationship, called a mutualism, benefits both the corals and the algae. Hence statement 2 is correct.
- Because of their intimate relationship with zooxanthellae, reef-building corals respond to the environment like plants. But the zooxanthellae are fast growing plants where as corals are slow growing colonies of animals. Hence statement 1 is correct.

97. Correct Answer: (d)

- Mammals are vertebrate animals that are endothermic, have hair on their bodies, and produce milk to feed their babies. Many mammals give birth to live young that are small. Regulating their own body

temperature and having hair of various thicknesses for protection has also allowed mammals to live in almost every habitat on Earth.

- Marine mammals are found in marine ecosystems around the globe. They are a diverse group of mammals with unique physical adaptations that allow them to thrive in the marine environment with extreme temperatures, depths, pressure, and darkness.
- Marine mammals are classified into four different taxonomic groups: cetaceans (whales, dolphins, and porpoises), pinnipeds (seals, sea lions, and walruses), sirenians (manatees and dugongs), and marine fissipeds (polar bears and sea otters).
- Sea cow, (Hydrodamalis gigas), also called Steller's sea cow is a very large aquatic mammal. Steller's sea cow belonged to the same family as the dugong. The extremely large size of Steller's sea cow functioned as an adaptation for survival in cool waters by providing the animal with a smaller ratio of surface area to volume. Hence option 2 is correct.
- Seals and sea lions are marine mammals called 'pinnipeds' that differ in physical characteristics and adaptations. They all have flippers at the end of their limbs to help them swim. Like all marine mammals, they have a thick layer of blubber to keep them warm in the chilly ocean. They are found primarily in Pacific waters. Hence option 4 is correct.
- Sea horse or Hippocampus is an example of marine bony fish. They are marine fish belonging to the genus Hippocampus of the family Syngnathidae. They are found in temperate and tropical waters all over the world. Seahorses range in size from 16 mm to 35 cm. They are notable for being the only species where the males get pregnant. Hence option 1 is not correct.
- Jellyfish are one of the oldest animals on Earth. They appeared before dinosaurs, between 500 and 700 million years ago. Jellyfish are found in every ocean, and even in some freshwater ponds and lakes. Most jellyfish prefer warm water, but some inhabit subarctic areas. Despite their name, jellyfish are not fish. They are a type of zooplankton that both drift in the ocean and have some swimming ability.
- Jellyfish are invertebrates; animals without skeletons. About 95% of their bodies are water. Jellyfish not only do not have bones, they have no brains, heads or hearts. Hence option 3 is not correct.
- Hence, option (d) is correct answer.

98. Correct Answer: (b)

- Ecologists and evolutionary biologists have proposed various hypotheses about greater biological diversity in tropics; some important ones are
- Speciation is generally a function of time, unlike temperate regions subjected to frequent glaciations in the past, tropical latitudes have remained relatively undisturbed for millions of years and thus had a long evolutionary time for species diversification. Hence option 4 is correct.
- Tropical environments, unlike temperate ones, are less seasonal, relatively more constant and predictable. Such constant environments promote niche specialisation and lead to a greater species diversity. Hence option 2 is correct.
- There is more solar energy available in the tropics, which contributes to higher productivity; this in turn might contribute indirectly to greater diversity. Hence option 3 is correct.
- Tropical soils are formed in areas with high annual temperature and rainfall. This climate that results in deep, highly weathered soils. The intense weathering causes these soils to be nutrient poor and low in organic matter and low in fertility. Hence option 1 is not correct.

99. Correct Answer: (d)

- Wetlands are unique, productive ecosystems where terrestrial and aquatic habitats meet. Wetlands play a critical role

in maintaining many natural cycles and supporting a wide range of biodiversity.

- Wetlands are particularly important providers of all water-related ecosystem services. They regulate water quantity, groundwater recharge, and can contribute to regulating floods and the impacts of storms. Wetlands also help in erosion control and sediment transport, thereby contributing to land formation and increasing resilience to storms. All these ecosystem services improve water security, including security from natural hazards and climate change adaptation.
- Wetlands have high recreational, historical, scientific, and cultural values. Wetlands have played an important part in human development and are of significant religious, historical or archaeological value to many cultures around the world. They are also often inviting places for popular recreational activities including hiking, fishing, bird watching, photography and hunting.
- Wetlands purify and filter harmful waste from water. Plants from wetlands help absorb harmful fertilizers and pesticides, as well as heavy metals and toxins from industry. They help in nutrients recycling, groundwater recharge and stabilisation of local climates.
- Wetlands act as nature's sponges. Peatlands, wet grasslands and floodplains in river basins act as natural sponges by absorbing rainfall and creating wide surface pools that ease flooding in rivers. The same storage capacity can also safeguard against drought.
- Wetlands help fight climate change. Peatlands alone store more than twice as much carbon as all the world's forests. Faced with rising sea levels, coastal wetlands reduce the impact of typhoons and tsunamis. They also bind the shoreline and resist erosion.
- Hence option (d) is the correct answer.

100. Correct Answer: (d)

- Adaptive radiation is a rapid increase in the number of species with a common ancestor, characterized by great ecological and morphological diversity. The driving force behind it is the adaptation of organisms to new ecological contexts.
- The phenomenon of adaptive radiation was first observed by Darwin when he travelled to a place called Galapagos Island. There he observed that there were finches with different types of beaks. So, he concluded that all of these inches radiated on the same island from a single ancestor Finch. All of these finches developed beaks according to the kind of food available to them. Hence, they evolved from the conventional seed-eating finches to vegetarian and insectivorous finches. They later came to be known as Darwin's finches. Hence option (d) is the correct answer.
- Gradual change in an organism to survive in an environment is called evolution.
- Speciation is the process by which new species are formed.
- Small changes that take place in the body of a single organism over short periods to overcome minor problems due to changes in the surroundings is called acclimatisation.