NCERT Class 12 Biology Exercise Solutions

Chapter 11 – Organisms and Populations

1. How is diapause different from hibernation?

Ans: Diapause is a period of halted growth to cope with unfavourable circumstances. Various types of Zooplankton and insects go through diapause to survive extreme weather conditions during their development. In contrast, hibernation or winter sleep is a time of rest for animals to avoid winter by seeking refuge in their shelters. They achieve this by reducing their metabolism and becoming inactive. Squirrels, bats, and certain rodents are known to undergo hibernation.

2. If a marine fish is placed in a freshwater aquarium, will the fish be able to survive? Why or why not?

Ans: Marine fish have a lower chance of surviving in a freshwater aquarium because their bodies are adapted to higher salt levels in the ocean. In freshwater, they struggle to control the water entering their bodies through osmosis. The fish's body swells due to the hypotonic environment outside, ultimately resulting in their death.

3. Most living organisms cannot survive at temperatures above 45 degree C. How are some microbes able to live in habitats with temperatures exceeding 100 degree C?

Ans: Thermophiles, also known as Archaebacteria, are ancient bacteria found in deep-sea hydrothermal vents and hot water springs. They can survive in high temperatures over 100 degrees Celsius because their bodies have adapted to extreme conditions. These organisms have special enzymes that can withstand such extreme temperatures and carry out metabolic functions effectively.

4. List the attributes that populations possess but not individuals.

Ans: A population is a group of entities of the same species living in a specific area at a particular time, functioning together. Here are the attributes of a population:

- Natality or Birth rate: The ratio of live births in an area to the population of that area.
- Mortality or Death rate: The ratio of deaths in a region to the population of that region.
- Age distribution: The percentage of individuals of different ages in a population.
- Sex ratio: The count of females or males per thousand individuals.
- Population density: The number of individuals in a population per unit at a specific time.

5. If a population grows exponentially double in size in 3 years, what is the intrinsic rate of increase (r) of the population?

Ans: If an adequate quantity of food resources is available to individuals in a population, it grows exponentially. The integral form of the exponential growth equation can be used to estimate the exponential growth, which is as follows:

$N_t = N_o e^{rt}$ ———— equation (1)

Where N_t is the population density after 't' time.

N_o is the population density at time zero.

e is the base of natural logarithm = 2.71828

r is the intrinsic rate of natural increase.

Let the current population density be 'x'.

∴ The population density after two years will be 2x, and the t given is 3 years.

Substituting these values in equation (1),

- $2x = x\, e^{3r}$
- $2 = e^{3r}$

Applying log on both the sides, we get

- $\log 2 = 3r \log e$
- $r = \frac{\log 2}{3 \log e}$
- $r = \frac{0.301}{3 \times 0.434}$
- $r = 0.2311$

Therefore, the intrinsic rate of natural increase of the population is 0.2311.

6. Name important defence mechanisms in plants against herbivory.

Ans: A state of feeding on plants is known as herbivory. Many plants have evolved mechanisms, both chemical and morphological, to safeguard themselves against the act of herbivory. Listed below are the defence mechanisms of a few plants:

Chemical defence mechanisms

- Caffeine, nicotine, opium, and quinine are some chemical substances that are produced in plants in response as part of their defence mechanism.
- All of the parts of Calotropis weeds consist of lethal cardiac glycosides that demonstrate to be fatal if consumed by herbivores.

Morphological defence mechanisms

- Opuntia or cactus leaves are altered into thorns or sharp spines to prevent herbivores from feeding on them.
- Margins of leaves in some plants are spiny, having sharp edges, preventing herbivores from feeding on them.
- Sharp thorns with leaves are found in Acacia to prevent herbivores from feeding on them.

7. An orchid plant is growing on the branch of a mango tree. How do you describe this interaction between the orchid and the mango tree?

Ans: An epiphyte, also known as an air plant, is a type of plant that grows on other plants. For example, an orchid growing on a mango tree branch is an epiphyte. These plants obtain their nutrients and moisture from the air, water, rain, or debris around them, rather than from the plant they are growing on. This relationship between a mango tree and an orchid is an example of commensalism, where one species benefits while the other remains unaffected. In this case, the orchid benefits by receiving physical support from the mango tree, while the mango tree is not affected.

8. What is the ecological principle behind the biological control method of managing pest insects?

Ans: The use of natural predators helps control pest insects by regulating their population through predation.

9. Distinguish between the following:

(a) Hibernation and Aestivation

(b) Ectotherms and Endotherms

Ans: The differences are as follows:

(a) Hibernation and Aestivation

Hibernation	**Aestivation**
Also known as winter sleep, it is a state of reduced activity observed in some entities to escape the extremely cold climatic conditions.	Also known as summer sleep, it is a state of reduced activity noticed in some entities to escape the dehydration as a result of heat in summer.
Examples: Squirrels and bears found in cold regions hibernate in winter.	Example: Snails and fishes aestivate in summer.

(b) Ectotherms and Endotherms

Ectotherms	**Endotherms**
The body temperature varies with their surroundings	Body temperature remains constant
They are cold blooded-entities	They are warm-blooded entities
Examples: reptiles, fishes, amphibians	Example: mammals and birds

10. Write a short note on

(a) Adaptations of desert plants and animals

(b) Adaptations of plants to water scarcity

(c) Behavioural adaptations in animals

(d) Importance of light to plants

(e) Effect of temperature or water scarcity and the adaptations of animals.

Ans: (a) Adaptations of desert plants and animals

Desert plants have evolved to survive in harsh conditions like extreme heat and lack of water. They have developed deep root systems to access underground water and features like sunken stomata and thick

cuticles to reduce water loss through transpiration. Some plants, like Opuntia, have modified leaves that perform photosynthesis through green stems. These plants also use specialized pathways like CAM or C4 to produce food while minimizing water loss by keeping their stomata closed during the day.

Desert animals, such as lizards, kangaroo rats, and snakes, have also adapted to their environment. For example, the kangaroo rat in the Arizona Desert can survive without ever drinking water by concentrating its urine to conserve water. Snakes and lizards in the desert bask in the sun in the morning and burrow in the sand in the afternoon to avoid the heat and prevent water loss.

(b) Adaptations of plants to water scarcity

Deserts are known for their extreme conditions like high temperatures and lack of water. Plants in deserts have adapted to these conditions by developing deep root systems to access underground water. They also have sunken stomata on their leaves and thick cuticles to reduce water loss through transpiration. For example, the Opuntia plant has transformed its leaves into spines and performs photosynthesis through its green stems. These desert plants use specialized pathways like CAM or C4 to produce food, allowing their stomata to remain closed during the day and minimize water loss from transpiration.

(c) Behavioural adaptations in animals

Certain living beings are impacted by changes in temperature and have developed adaptations to cope with these fluctuations. These adaptations include aestivation, hibernation, and migration, which help them adjust to their natural environment. These changes in behaviour are known as behavioural adaptations. For example, animals like amphibians, fish, and reptiles, which are ectothermic or cold-blooded, experience temperature changes based on their surroundings. Desert lizards, for instance, bask in the sun during the early hours of the day and seek shelter in the sand as the temperature rises in the afternoon. On the other hand, warm-blooded animals like mammals and birds, known as endotherms, deal with extreme weather conditions by hibernating during winter and aestivating during summer. They find refuge in burrows, caves, and other safe places to protect themselves from these temperature variations.

(d) Importance of light to plants

Plants rely on sunlight as their main source of energy. They are known as autotrophic organisms because they can produce their own food through a process called photosynthesis. Sunlight plays a crucial role in this process, as it triggers a photoperiodic response in plants. This response allows plants to adjust to changes in light intensity during different seasons, ensuring they can meet their specific requirements for flowering. Moreover, light also plays a vital role in aquatic environments, influencing the vertical distribution of plants in the sea.

(e) Effect of temperature or water scarcity and the adaptations of animals

The temperature is a crucial ecological factor that varies from one place to another, impacting the distribution of animals worldwide. Eurythermal animals can handle a wide range of temperatures, while stenothermal animals can only tolerate a narrow range. Animals adapt to their habitats, like those in cooler regions having short limbs and ears to retain heat. Creatures in colder areas have thick fat layers and fur

coats to stay warm. Some animals, like desert lizards, use behavioural adaptations like aestivation, hibernation, and migration to cope with temperature changes. Water scarcity also drives animals like kangaroo rats and snakes in deserts to adapt, such as the kangaroo rat that can survive without drinking water and concentrate urine to save water.

11. List the various abiotic environmental factors.

Ans: Abiotic environmental factors encompass all the non-living elements within an ecosystem. These factors include temperature, water, soil, and light.

Temperature - Temperature plays a crucial role in shaping ecosystems. It exhibits seasonal variations and generally decreases from the equator to the poles and from lowlands to mountain peaks. The temperature range is vast, ranging from sub-zero levels in polar regions to over 50 degrees Celsius in tropical deserts during summer. Some extreme habitats, like deep-sea hydrothermal vents and thermal springs, experience average temperatures exceeding 100 degrees Celsius. Organisms that can tolerate a wide range of temperatures are known as eurythermal, such as birds and mammals. Conversely, stenothermal organisms can only withstand a narrow temperature range, like polar bears.

Water - Water is essential for sustaining life. For marine organisms, factors like pH, water temperature, and chemical composition are significant. Water salinity also plays a crucial role, with inland water having less than 5 parts per thousand salinity and the sea having 30-35 parts per thousand salinity. Euryhaline organisms can tolerate a wide range of salinity, while stenohaline organisms can only tolerate a narrow range. Most freshwater animals cannot survive in seawater for extended periods due to osmotic challenges caused by high salinity, and vice versa.

Soil - Soil properties and characteristics vary depending on factors like climate, soil development process, and weathering process. Grain size, aggregation, and composition determine the water-holding capacity and percolation of soil. Other features like pH, topography, and mineral composition also influence the types of plants that can thrive in a specific habitat.

Light - Light is crucial for autotrophs as they rely on it for photosynthesis, which releases oxygen as a byproduct. In forest ecosystems, smaller plants like herbs and shrubs have adapted to carry out photosynthesis under low light intensities as they are overshadowed by taller trees.

12. Give an example for:

(a) An endothermic animal

(b) An ectothermic animal

(c) An organism of benthic zone

Ans: (a) An endothermic animal – Crows, sparrows, cranes, cows, rabbits, rats, etc.

(b) An ectothermic animal – Fish such as amphibians, sharks, frogs, snakes, tortoises, lizards, etc.

(c) An organism of the benthic zone – Decomposing bacteria is an organism of the benthic zone.

13. Define population and community.

Ans: Population – Population refers to a collective of individuals belonging to the same species residing in a specific geographic location at a given moment, operating as a cohesive entity.

Community – It can be defined as a collection of individuals from different species coexisting within a particular geographical region. These individuals may possess similarities or differences but are unable to reproduce with members of other species.

14. Define the following terms and give one example for each:

(a) Commensalism

(b) Parasitism

(c) Camouflage

(d) Mutualism

(e) Interspecific competition

Ans: (a) Commensalism

Commensalism is a type of relationship between two species where one species benefits while the other is not affected. Examples include barnacles attaching to a whale's body and an orchid growing on the branches of a mango tree.

(b) Parasitism

Parasitism is a type of relationship between two species where one species, usually the smaller one, benefits while the other, typically the larger one, is harmed. For instance, a tick feeds on the blood of a host, gaining nutrients and energy, while the host may suffer from skin irritation or disease due to the tick's presence.

(c) Camouflage

Organisms often utilize camouflage as a strategy to evade predators in their natural habitats. This tactic involves blending in with the environment through coloration, allowing them to avoid detection by potential threats. Insects and certain frog species are known to employ this method effectively to ensure their survival.

(d) Mutualism

Mutualism is a type of interaction between two species where both parties involved receive benefits. For instance, lichens demonstrate a mutual symbiotic relationship between blue-green algae and fungi, with both organisms mutually benefiting from each other.

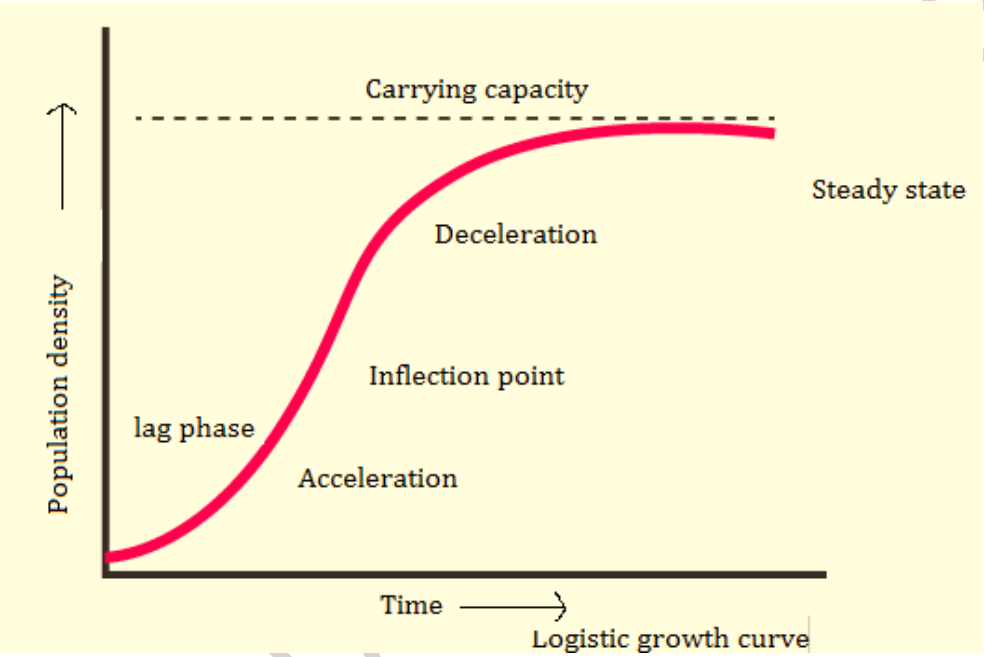
(e) Interspecific competition

Interspecific competition occurs when two different species compete for the same limited resources, resulting in negative impacts on both populations. An example of this can be seen in the competition between bees and butterflies for nectar from the same flowers in a garden.

15. With the help of a suitable diagram, describe the logistic population growth curve.

Ans: The logistic growth pattern is commonly observed in yeast cells that are cultivated under controlled laboratory conditions. This growth pattern consists of five distinct phases:

1. Lag phase: Initially, the yeast cell population is small due to limited resources in the environment.
2. Exponential phase: During this stage, the yeast cell population experiences a sudden increase in growth rate. Sufficient food resources and favourable environmental conditions contribute to exponential population growth. The growth curve rises steeply during this phase.
3. Positive acceleration phase: At the beginning of this phase, cell growth is limited. However, the yeast cells adapt to the new environment and their population continues to grow.
4. Negative acceleration phase: As environmental resistance increases, the growth rate of the yeast cell population declines. Increased competition for resources, such as shelter and food, leads to a decrease in growth rate.
5. Stationary phase: In this phase, the population size remains stable. The number of cells generated is equal to the number of cells that die out. The population has reached its carrying capacity in the habitat. This phase is also known as the Verhulst-Pearl logistic curve, which is represented by an S-shaped growth curve.



16. Select the statement which explains best parasitism.

(a) One organism is benefited.

(b) Both the organisms are benefited.

(c) One organism is benefited, other is not affected.

(d) One organism is benefited, and another is affected.

Ans: (d) One organism is benefited, and another is affected.

Parasitism refers to a form of interaction between two species in which one species, known as the parasite, gains advantages while the other species, the host, experiences negative consequences. For instance, the presence of lice or ticks on the human body exemplifies parasitism. In this case, lice obtain their nourishment by feeding on the blood of humans, leading to a decrease in the host's fitness and causing harm to the human body.

17. List any three important characteristics of a population and explain.

Ans: A population can be defined as a collection of entities belonging to the same species, residing in a specific geographical area at a particular time, and functioning together as a unit. For instance, all humans living in a particular area at a specific time form the population of humans.

The following characteristics are observed in a population:

1. Natality or Birth rate: This refers to the number of live births in a specific area compared to the population of that area. The birth rate can be expressed as the number of individuals added to the population in terms of its existing members.

2. Mortality or Death rate: The death rate is the ratio of deaths in a particular region to the population of that region. It represents the loss of individuals in terms of the population size.

3. Age distribution: This attribute describes the percentage of individuals of different ages within a given population. A population consists of individuals belonging to various age groups at any given time. Typically, an age pyramid is used to visually represent the age distribution pattern.