

Chapter: Organisms and population

Exercise

Question 1. How is diapause different from hibernation?

Answer:

Diapause is a stage of growth that is paused to cope with unfavorable circumstances. Many zooplankton and insect species go through diapause throughout their growth to avoid harsh climatic circumstances. Hibernation, often known as winter slumber, is a resting stage in which animals hide in their shelters to avoid the cold of winter. They avoid the winter by decreasing their metabolism and assuming a condition of dormancy. Bats, squirrels, and other rodents display the hibernation phenomena.

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

Answer:

A marine fish's chances of survival will be reduced if it is kept in a freshwater aquarium. This is because their bodies have evolved to withstand the high salt concentrations seen in the maritime environment. They are unable to control the amount of water that enters their bodies in freshwater (through osmosis). Because of the hypotonic atmosphere outside, water penetrates their bodies. This causes the body to inflate, finally resulting in the death of the marine fish.

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

Answer:

Thermophiles (Archaeobacteria) are ancient bacteria found in hot springs and deep-sea hydrothermal vents. They can survive in extreme heat (temperatures well beyond 100°C) because their bodies have adapted to such conditions. These organisms have unique thermo-resistant enzymes that carry out metabolic tasks that aren't damaged by extreme heat.

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

Answer:

A population is a collection of individuals of the same species living in a specific geographic area at a specific time and acting as a single entity. The population of humans, for example, is made up of all human beings who are present in a given location at a given time.

The following are the primary traits or characteristics of a population in a certain area:

Birth rate (Natality): It is the ratio of live births to the population in a certain location. It is computed by dividing the number of persons added to the population by the total population.

Death rate (Mortality): It is the ratio of deaths per 100,000 person in a given location. It is counted in terms of how many people have died of the sickness in a given area at a certain time.

Sex ratio: The number of males and females per thousand people is known as the male-to-female ratio.

Age Distribution: It is the proportion of people of various ages in a given population. At any one time, the population is made up of people of diverse ages. Age pyramids are a popular way to depict the age distribution pattern.

Population density: It is the number of people in a population who are present per unit area at any given time.

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

Answer:

If a person has access to sufficient food resources, the population will grow exponentially. The integral form of the exponential growth equation can be used to compute its exponential growth:

$$N_t = N_0 e^{rt}$$

Where,

N_t = Population density after time t

N_0 = Population density at time zero

r = Intrinsic rate of natural increase

e = Base of natural logarithms

The intrinsic rate of rising (r) of a population can be calculated using the equation above.

Now, in response to the query,

Present population density = x

Then,

Population density after two years = $2x$

$t=3$ years

When these values are substituted in the formula, we get:

$$2x = x e^{3r}$$

$$2 = e^{3r}$$

Applying log on both sides:

$$\log 2 = 3r \log e$$

$$\frac{\log 2}{3 \log e} = r$$

$$\frac{\log 2}{3 \times 0.434} = r$$

$$\frac{0.301}{3 \times 0.434} = r$$

$$r = 0.2311$$

As a result, the intrinsic rate of rising for the population depicted above is 0.2311.

Question 6. Name important defense mechanisms in plants against herbivory.

Answer:

Several plants have evolved morphological and pharmacological methods to protect themselves from herbivory.

Morphological defense mechanisms:

To keep herbivores away from cactus leaves (Opuntia), sharp spines (thorns) are added to them.

Acacia plants have sharp thorns and leave to dissuade herbivores.

The margins of some plants' leaves are spiky or have sharp edges, preventing herbivores from eating them.

Chemical defense mechanisms:

Calotropis weeds have toxic cardiac glycosides in all sections, which can be lethal to herbivores if ingested.

Plants generate chemical compounds such as nicotine, caffeine, quinine, and opium as a form of self-defense.

Question 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?

Answer:

An epiphyte is a type of orchid that grows on the limb of a mango tree. Plants that grow on other plants but do not use their nutrients are known as epiphytes. As a result, the relationship between a mango tree and an orchid is one of commensalism, where one species benefits while the other remains unaffected. The orchid is helped by the above interaction whilst the mango tree is unaffected.

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

Answer:

The principle of predation is at the heart of many biological control approaches. Predation is a biological relationship between a predator and prey in which the predator feeds on the prey. As a result, predators help to manage nuisance insects by regulating the population of prey in an environment.

Question 9. Distinguish between the following:

- a. **Hibernation and Aestivation**
- b. **Ectotherms and Endotherms**

Answer:

a. Hibernation and Aestivation

Hibernation		Aestivation	
1.	Hibernation is a state of reduced activity in which some creatures go to avoid the cold of winter.	1.	Aestivation is a reduced activity condition that some organisms go into during the summer to avoid desiccation from the heat.
2.	Animals that hibernate throughout the winter include bears and squirrels that live in frigid climates.	2.	During the summer, creatures such as fish and snails aestivate.

b. Ectotherms and Endotherms

Ectotherms		Endotherms	
1.	Ectotherms are creatures that have cold blood. Their body temperature is affected by their surroundings.	1.	Warm-blooded animals are known as endotherms. They keep their body temperature consistent.
2.	Ectothermic animals include fish, amphibians, and reptiles.	2.	Endotherms include birds and mammals.

Question 10. Write a short note on

- a) **Adaptations of desert plants and animals.**
- b) **Adaptations of plants to water scarcity**
- c) **Behavioral adaptations in animals**
- d) **Importance of light to plants**
- e) **Effect of temperature or water scarcity and the adaptations of animals**

Answer:

a. Adaptations of desert plants:

Desert plants have evolved to cope with difficult desert circumstances such as water scarcity and extreme heat. Plants have a deep root system that allows them to access subsurface water. To minimize transpiration, they have thick cuticles and depressed stomata on the surface of their leaves. The leaves of *Opuntia* have been completely transformed into spines, and photosynthesis is carried out by green stalks. CAM pathways are used by desert plants to produce nourishment (C^4 pathway). It allows the stomata to remain closed throughout the day, reducing water loss through transpiration.

Adaptations of desert animals:

Desert animals, such as desert kangaroo rats, lizards, and snakes, are well suited to their environment. The kangaroo rat, which can be found in Arizona's deserts, never drinks water. It can concentrate its urine to save water. Desert lizards and snakes bask in the sun early in the morning and burrow under the sand in the afternoons to avoid the heat. Desert animals have developed these adaptations to reduce water loss.

b. Adaptations of plants to water scarcity:

Desert plants have evolved to cope with the desert's water scarcity and searing heat. Plants have a deep root system that allows them to access subsurface water. To minimize transpiration, they have thick cuticles and depressed stomata on the surface of their leaves. The leaves of *Opuntia* have been changed into spines, and the photosynthesis process is carried out by green stalks. CAM pathways are used by desert plants to produce nourishment (C₄ pathway). It allows them to keep their stomata closed during the day, reducing water loss through transpiration.

c. Behavioral adaptations in animals:

Temperature changes have an impact on some creatures. To avoid environmental stress and to suit their natural habitat, these species undergo adaptations such as hibernation, aestivation, migration, and so on. These changes in an organism's behavior are referred to as behavioral adaptations. Ectothermic animals and some endotherms, for example, have behavioral adaptations. (d) Importance of light to plants.

Fish, amphibians, reptiles, and other cold-blooded animals are examples of ectotherms. Their temperature fluctuates depending on their surroundings. The desert lizard, for example, basks in the sun during the early morning hours when the temperature is still cool. However, as the temperature rises, the lizard burrows under the sand to protect itself from the blazing heat. Other desert animals use burrowing tactics that are similar to theirs. Endotherms (warm-blooded creatures) like birds and mammals hibernate in the winter and aestivate in the summer to avoid the cold and hot weather. To protect themselves from temperature changes, they hide in caves, burrows, and other shelters.

d. Importance of light to plants.

For plants, sunlight is the most important source of energy. Plants are phototrophic creatures that require light to complete the photosynthesis process. Light is also vital in the development of photoperiodic responses in plants. Plants adapt to fluctuations in light intensity throughout the seasons to meet their photoperiodic flowering requirements. In aquatic ecosystems, light is especially vital for the vertical dispersion of plants in the water.

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

The most essential ecological component is temperature. The average temperature of the planet varies from one location to the next. The distribution of creatures on the planet is affected by these temperature differences. Eurythermal are animals that can survive a wide variety of temperatures. Stenothermal animals are those that can only withstand a small temperature range. Adaptations are also made by animals to suit their ecological surroundings. Animals in cooler climates, for example, have shorter ears and limbs to avoid heat loss from their bodies. To prevent heat loss, animals in polar climates have large amounts of fat beneath their skin and thick coats of fur.

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Water scarcity is another aspect that pushes animals to change their behavior to fit their natural environment. Desert animals, such as desert kangaroo rats, lizards, and snakes, are well suited to stay in their natural habitat. The kangaroo rat, which can be found in Arizona's deserts, never drinks water. It can concentrate its urine to save water. Early in the morning, desert lizards and snakes lounge in the sun, then burrow under the sand as the temperature rises to avoid the heat of the day. Such changes can be considered as a means of preventing water loss.

Question 11. List the various abiotic environmental factors.

Answer:

Abiotic components or factors are non-living chemical and physical components of the environment, according to biology and ecology. They have a negative impact on living beings and ecosystems.

Living organisms' growth, maintenance, and reproduction are influenced by abiotic variables such as physical freshwater, in-depth circumstances, and non-living resources. Abiotic components include all non-living elements like atmospheric conditions and water resources. Water, light, radiation, temperature, humidity, atmosphere, acidity, and soil are some of the other abiotic elements to consider. The macroscopic climate affects all of these factors. Abiotic elements include pressure and sound waves in marine and subterranean habitats. In contrast, aerial exposure, substrate, water clarity, solar energy, and tides are all biotic elements in ocean ecosystems.

Question 12. Give an example for:

- a. **An Endothermic animal**
- b. **An ectothermic animal**
- c. **An organism of the benthic zone**

Answer:

a) An Endothermic animal

Creatures include birds like crows, sparrows, pigeons, cranes, and mammals like bears, cows, rats, and rabbits, among others.

b) An ectothermic animal

Ectothermic animals include sharks, frogs, tortoises, snakes, and lizards, as well as reptiles like tortoises, snakes, and lizards.

c) An organism of the benthic zone

Benthic zone organism: Decomposing bacteria is an example of an organism found in a water body's benthic zone.

Question 13. Define population and community.

Answer:

Population:

A population is a collection of individuals of the same species living in a specific geographic area at a specific time and acting as a single entity. The population of humans, for example, is made up of all human beings who are present in a given location at a given time.

Community:

A community is described as a group of people of various species who live in a specific geographic location. Individuals of this type can be similar or distinct, but they are unable to reproduce with members of other species.

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

a. Commensalism

b. Parasitism

c. Camouflage

d. Mutualism

e. Interspecific competition

Answer:

a. Commensalism

Commensalism is a mutualistic relationship between two species in which one benefits while the other is unaffected. Commensalisms include orchids blooming on mango tree branches and barnacles adhering to the bodies of whales.

b. Parasitism

It is a two-species interaction in which one species (typically smaller) is positively influenced while the other (usually larger) is negatively affected. The liver fluke is an example of this. The liver fluke is a parasitic parasite that dwells inside the host's liver and feeds on it. As a result, the parasite benefits because it gets nutrients from the host, while the host suffers because the parasite lowers the host's fitness, making its body weak.

c. Camouflage

It's a defense mechanism used by prey species to avoid predators. Organisms are colored in cryptic patterns so that they can blend in with their surroundings and avoid predators. Many frogs and insects blend in with their surroundings to avoid being eaten by predators.

d. Mutualism

It is a two-species interaction in which both of the species involved benefit. Lichens, for example, illustrate a mutual symbiotic interaction between fungi and blue-green algae, in which both benefit equally.

e. Interspecific competition

It is an interaction between individuals of different species that has a negative impact on both species. Consider the competition for common food resources, such as zooplankton, between flamingos and resident fishes in South American lakes.

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

Answer:

In yeast cells maintained under laboratory conditions, the logistic population growth curve is widely observed. The five stages are the lag phase, positive acceleration phase, exponential phase, negative acceleration phase, and stationary phase.

Lag phase: The population of yeast cells is quite modest at first. Because of the habitat's low resources, this is the case.

Positive acceleration phase: During this phase, the yeast cell adjusts to its new surroundings and begins to multiply. However, the cell's growth is severely limited at the start of this phase.

Exponential phase: Due to rapid expansion, the population of the yeast cell increases dramatically during this phase. Because there are enough food resources, the environment is stable, and there is no interspecific competition, the population grows exponentially. As a result, the curvature sharply ascends.

Negative acceleration phase: The environmental resistance grows throughout this era, whereas the population growth rate drops. This is due to increased competition for food and shelter among yeast cells.

Stationary phase: The population becomes stable throughout this time. In a population, the number of cells generated equals the number of cells that die. In addition, the species' population is reported to have reached nature's carrying capacity in its habitat.

Question 16. Select the statement which explains the 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, other is affected.

Answer: (c)

c. One organism is benefited, other is affected.

Parasitism is a two-species interaction in which one species (parasite) benefits while the other species (host) suffers harm. Ticks and lice (parasites) on the human body, for example, show this dynamic in which the parasites profit (as they derive nourishment by feeding on the blood of humans). These parasites, on the other hand, diminish host fitness and injure the human body.

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

Answer:

A population is a group of individuals from the same species living in the same geographic region at the same time and operating as a single unit. The population of humans, for example, is made up of all human beings who are present in a given location at a given time. A population's three most important qualities are:

Birth rate (Natality):

It is the proportion of live births to the population in a given area. It is computed by dividing the number of persons added to the population by the total population.

Death rate (Mortality):

It's the number of deaths per 1,000 persons in a certain area. It is counted in terms of how many individuals have died as a result of the sickness.

Age Distribution:

In a particular population, it is the proportion of people of various ages. A population is made up of people of various ages at any one time. Age pyramids are a popular approach to represent the pattern of age distribution.

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