

Maharashtra State Board 12th Biology Solutions Chapter 13

Organisms and Populations

1. Multiple choice questions

Question 1.

Which factor of an ecosystem includes plants, animals, and microorganisms?

- (a) Biotic factor
- (b) Abiotic factor
- (c) Direct factor
- (d) Indirect factor

Answer:

- (a) Biotic factor

Question 2.

An assemblage of individuals of different species living in the same habitat and having functional interactions is

- (a) Biotic community
- (b) Ecological niche
- (c) Population
- (d) Ecosystem

Answer:

- (a) Biotic community

Question 3.

Association between sea anemone and Hermit crab in gastropod shell is that of

- (a) Mutualism
- (b) Commensalism
- (c) Parasitism
- (d) Amensalism

Answer:

- (b) Commensalism

Question 4.

Select the statement which explains best parasitism.

- (a) One species is benefited.
- (b) Both the species are benefited.
- (c) One species is benefited, other is not affected.
- (d) One species is benefited, other is harmed.

Answer:

- (d) One species is benefited, other is harmed.

Question 5.

Growth of bacteria in a newly inoculated agar plate shows

- (a) exponential growth
- (b) logistic growth
- (c) Verhulst-Pearl logistic growth
- (d) zero growth

Answer:

- (c) Verhulst-Pearl logistic growth

2. Very short answer questions.

Question 1.

Define the following terms

a. Commensalism

Answer:

The interaction between two species in which one species gets benefits and the other is neither harmed nor benefited is called commensalism.

b. Parasitism

Answer:

The interaction between two species in which one parasitic species derives benefit from the other host species by harming it is called parasitism.

c. Camouflage

Answer:

Camouflage is the disguising colouration or behaviour to merge with the surrounding so that prey or predator can remain hidden.

Question 2.

Give one example for each

- a. Mutualism
- b. Interspecific competition

Answer:

a. Lichen is composed of alga (cyanobacteria) and fungus. They cannot survive independently. Their association is mutualistic alga synthesises food by photosynthesis and fungus does the absorption of moisture.

b. Leopard and lion competing for a same prey. Sheep and cow competing for grazing in the same land.

Question 3.

Name the type of association:

- a. Clown fish and sea anemone
- b. Crow feeding the hatchling of Koel
- c. Humming birds and host flowering plants

Answer:

- a. Commensalism
- b. Brood parasitism
- c. Mutualism

Question 4.

What is the ecological process behind the biological control method of managing with pest insects?

Answer:

1. Pest insects act as prey to predator birds or frogs.
2. The biological control method consists of releasing the predators in the farms so that they can control the pest population in the natural way.
3. This also eliminates the use of chemical pesticides.
4. Frogs are natural predators of locust, therefore the population of this hazardous insect is controlled by frogs and the produce from agricultural farm can be saved.

Protocooperation:

1. Protocooperation is a type of population interaction where two species interact with each other.
2. Both are benefited but they have no need to interact with each other.
3. They can survive and grow even in the absence of other species.
4. Therefore this interaction is purely for the gain that they receive in such type of interaction.
5. The interaction that occurs can be between different kingdoms.

3. Short answer questions.

Question 1.

How is the dormancy of seeds different from hibernation in animals?

Answer:

In dormancy seed is not showing any metabolic activities. It can come back to life if and only if it gets suitable moisture and sunlight. Hibernation is suspended state, in which metabolic reactions do take place but at a very reduced pace. Animal arouses on its own after the winter sleep is over. This arousal is spontaneous and depends upon the ambient temperature. Dormant seed does not show such change unless it is planted or thrown in to moist place.

Question 2.

If a marine fish is placed in a fresh water aquarium, will it be able to survive? Give reason.

Answer:

Marine fish has its own osmoregulation which is different from the osmoregulation seen in fresh water fish. In marine water, the ambient salinity is more than the concentration of ions in the body. But in fresh water reverse is the case. Therefore, marine fish has different machinery to cope up with high saline environment. Therefore, it cannot survive in fresh water as its osmoregulation is not possible in less saline waters.

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Question 4.

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

Answer:

1. Orchid is an epiphyte. It gets the support from the mango tree. But it does not cause any harm to the mango tree.
2. Mango tree does not derive any benefit from this association. Therefore, this interaction is of type of commensalism.

Question 5.

Distinguish between the following:

a. Hibernation and Aestivation

Answer:

Hibernation	Aestivation
1. Hibernation is winter sleep shown by some warm-blooded and some cold-blooded animals.	1. Aestivation is the type of summer sleep, shown by cold-blooded animals.
2. It is for the whole winter.	2. It is of short duration.
3. The animals look out for the warmer place to enter into hibernation.	3. Animals search for the moist, shady and cool place to sleep.
4. Metabolic activities of hibernators slowdown in this dormant stage.	4. Metabolic activities of aestivators remain low during aestivation period.
5. Hibernation helps in maintaining the body temperature and prevents any internal body damage due to low temperatures. E.g. Bats, birds, mammals, insects, etc. show hibernation.	5. Aestivation helps in maintaining the body temperature by avoiding the excessive water loss and thus prevents any internal body damaged due to high temperatures. E.g. Bees, snails, earthworms, salamanders, frogs, earthworms, crocodiles, tortoise, etc. show aestivation.

b. Ectotherms and Endotherms

Answer:

Ectotherms	Endotherms
1. Ectotherms do not have ability to generate heat in the body.	1. Endotherms possess the ability to generate their own body heat.
2. Ectotherms depend on the environmental sources to heat their bodies. E.g sunlight.	2. Endotherms do not depend upon outside sources to generate heat.
3. Most ectotherms are confined to warmer parts of the world.	3. Endotherms inhabit coldest parts of the earth.
4. Body temperature of ectotherms fluctuate according to ambient temperature.	4. Body temperatures of endotherms remain constant and do not show fluctuations as per ambient temperatures.
5. Metabolic rate of ectotherms is low. E.g. Amphibians and reptiles.	5. Metabolic rate of endotherms is high. E.g. Mammals and birds

c. Parasitism and Mutualism

Answer:

Parasitism	Mutualism
1. Parasitism is the relationship where only one organism receive benefits, while the other is harmed in return.	1. Mutualism is the relationship where both the organisms of distinct species are benefited.
2. Parasite cannot survive without host but if the host is overexploited then parasite too dies.	2. Both the species are dependent on each other for their benefits and survival.
3. Parasitism can be facultative or obligatory.	3. Mutualism is obligatory relationship.
4. Parasitism is a negative interaction.	4. Mutualism is a positive interaction.

Question 6.

Write a short note on

a. Adaptations of desert animals

Answer:

1. Animals which are well-adapted to live in deserts are called xerocoles. These animals show adaptations for water conservation or heat tolerance.
2. These animals show low basal metabolic rate. They obtain moisture from succulent plants and rarely drink water. E.g Gazella and Oryx.
3. Desert animals like camel produce concentrated urine and dry dung.
4. Many other hot desert animals are nocturnal, seeking out shade during the day or dwelling underground in burrows.
5. Smaller animals from desert, emerge from their burrows at night.
6. Mammals living in cold deserts have developed greater insulation through warmer body fur and insulating layers of fat beneath the skin.
7. Few adaptations to desert life are unable to cool themselves by sweating so they shelter during the heat of the day. Many desert reptiles are ambush predators and often bury themselves in the sand, waiting for prey to come within range.
8. Other animals have bodies designed to save water. Scorpions and wolf spiders have a thick outer covering which reduces moisture loss. The kidneys of desert animals concentrate urine, so that they excrete less water.

b. Adaptations of plants to water scarcity

Or

Adaptations in desert plants.

Answer:

1. Thick cuticle on their leaf surfaces
2. Stomata of desert plants is sunken that it is in deep pits to minimize loss of water through transpiration.
3. Desert plants also have a special photosynthetic pathway (CAM -Crassulacean acid metabolism) that enables their stomata to remain closed during daytime.
4. Some desert plants like Opuntia, have their leaves reduced or they are modified to spines. Loss of leaf surface helps in prevention of transpiration.
5. Photosynthetic function is taken over by the flattened stems called as phylloclade.

c. Behavioural adaptations in animals

Answer:

1. Behavioural responses to cope with variations in their environment are shown by few animals.
2. Desert lizards manage to keep their body temperature fairly constant by behavioural adaptations. They bask in the sun and absorb heat, when their body temperature drops below the comfort zone, but move into shade, when the ambient temperature starts increasing. Even snakes also show basking during winter months.
3. Since they are ectothermic, this kind of behaviour saves them from extreme temperatures.
4. Many smaller animals show burrowing behaviour to adapt to the temperature extremes.
5. Some species burrow into the sand to hide and escape from the heat.
6. Migrations shown by the birds and mammals are also behavioural responses for adapting to severe winter temperatures.

Question 7.

Define Population and Community.

Answer:

Population:

Group of organisms belonging to same species that can potentially interbreed with each other and live together in a well-defined geographical area by sharing or competing for similar resources, is called population.

Community:

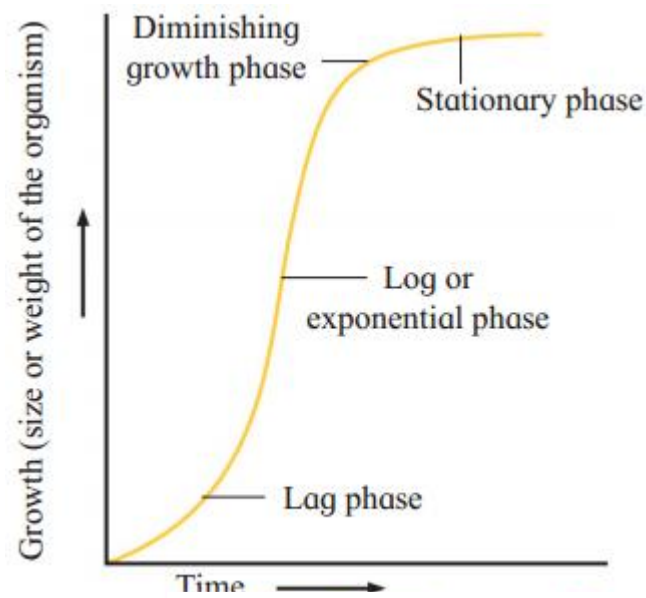
Several populations of different species in a particular area makes a community.

4. Long answer questions.

Question 1.

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

Answer:



1. Naturally all populations of any species always have limited resources to permit exponential growth. Due to this there is always competition between individuals for limited resources. The most fit organisms succeed by survival and reproduction.
2. A given habitat has enough resources to support a maximum possible number, but beyond a particular limit the further growth is impossible.
3. This limit is called nature's carrying capacity (K) for that species in that habitat.
4. A population growing in a habitat with limited resources show following phases in a sequential manner, (a) A lag phase (b) Phase of acceleration (c) Phase of deceleration (d) An asymptote, when the population density reaches the carrying capacity.
5. A plot of N in relation to time (t) results in a sigmoid curve. This type of population growth is called Verhulst-Pearl Logistic Growth.
6. Since resources for growth for most animal populations are finite and become limiting sooner or later, the logistic growth model is considered as a more realistic one.
7. Logistic growth thus always shows sigmoid curve.

Question 2.

Enlist and explain the important characteristics of a population.

Answer:

Important characteristics of a population are as follows:

1. Natality:

1. Natality is the birth rate of a population. Due to increased natality the population density rises.
2. Natality is a crude birth rate or specific birth rate.
3. Crude birth rate : Number of births per 1000 population/year gives crude birth rate. Crude birth rate is helpful in calculating population size.
4. Specific birth rate : Crude birth rate is relative to a specific criterion such as age. E.g. If in a pond, there were 200 carp fish and their population rises to 800. Then, taking the current population to 1000, the birth rate becomes $800/200 = 4$ offspring per carp per year. This is specific birth rate.
5. Absolute Natality : The number of births under ideal conditions when there is no competition and the resources such as food and water are abundant, then it give absolute natality.
6. Realized Natality : The number of births under different environmental pressures give realized natality. Absolute natality will be always more than realized natality.

2. Mortality:

1. Mortality is the death rate of a population. It gives a measure of the number of deaths in a particular population, in proportion to the size of that population, per unit of time.
2. Mortality rate is typically expressed in deaths per 1,000 individuals per year.
A mortality rate of 9.5 (out of 1,000) in a population of 1,000 would mean 9.5 deaths per year in that entire population or 0.95% out of the total.
3. Absolute Mortality : The number of deaths under ideal conditions when there is no competition, and all the resources such as food and water are abundant, then it gives absolute mortality.
4. Realized Mortality : The number of deaths under environmental pressures come into play gives realized mortality.
5. It must be remembered that absolute mortality will always be less than realized mortality.

3. Density:

The density of a population in a given habitat during a given period fluctuates due to changes in four basic processes, viz.

1. Natality i.e. birth rate (The number of births during a given period in the population that are added to the initial density).
2. Mortality i.e. death rate (The number of deaths in the population during a given period).
3. Immigration i.e. number of individuals of the same species that have come into the habitat from elsewhere during the time period under consideration.

4. Emigration i.e. the number of individuals of the population who left the habitat and gone elsewhere during the time period under consideration.
5. Natality and immigration increase in population density whereas mortality and emigration decrease it.

4. Sex ratio : Ratio of the number of individuals of one sex (male) to that of the other sex (female) is called sex ratio. In nature male, female ratio is always 1 : 1. This 1 : 1 ratio is called evolutionary stable strategy of ESS for each population.

5. Age distribution and age pyramid : This parameter is important for human population. Each population is composed of individuals of different ages. The age distribution is plotted for the population, the resulting structure is called an age pyramid. For making the age pyramid, the entire population is divided into three age groups as Pre-Reproductive (age 0-14 years), Reproductive (age 15-44 years) and Post-reproductive (age 45 -85+ years).

6. Growth : Growth of a population causes rise in its density. The size and density are dynamic parameters as they keep on changing with time, and various factors including food, predation pressure and adverse weather. From the density, one comes to know if the population is flourishing or declining.

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