Organisms and Populations-1

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1. How is diapause different from hibernation?

	Diapause	Hibernation
1	Diapause is a stage of suspended development to cope with unfavourable conditions.	Hibernation or winter sleep is a resting stage where in animals escape winters (cold) by hiding themselves in their shelters. They escape the winter season by entering a state of inactivity by slowing their metabolism.
2	Many species of zooplankton and insects exhibit diapause to tide over adverse climatic conditions during their development.	The phenomenon of hibernation is exhibited by bats, squirrels, and other rodents

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

If a marine fish is placed in a fresh water aquarium, they cannot survive.

The bodies of marine fishes are adapted to high salt concentrations of the marine environment.

In fresh water conditions, they are unable to regulate the water entering their body (through osmosis).

Water enters their body by means of endosmosis due to the hypotonic environment outside.

This causes swelling up of the body and leading to the death of the marine fish.

3. Define phenotypic adaptation. Give one example.

Phenotypic adaptation is the change in the appearance of organisms due to genetic mutation or in response to the surrounding environment.

Example:

1. Evolution of light-coloured moths in dark-coloured populations is a phenotypic adaptation that imparts a survival advantage in polluted areas.

2. Presence of thick cuticle and sunken stomata on the leaf surface of desert plants to prevent loss of water during transpiration.
3. Elephants have long ears that work similarly to that of a hand fan we use during summer when the temperature is high. It acts as a thermoregulator.

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

Archaebacteria (Thermophiles) are ancient forms of bacteria found in hot water springs and deep sea hydrothermal vents.

They are able to survive in high temperatures (which far exceed 100°C) because their bodies have adapted to such environmental conditions.

These organisms contain specialized thermo-resistant enzymes, which carry out metabolic functions that do not get destroyed at such high temperatures.

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

A population can be defined as a group of individuals of the same species residing in a particular geographical area at a particular time and functioning as a unit.

- An individual may have births and deaths, but a population has birth rates and death rates.
- An individual is either a male or a female but a population has a sex ratio (e.g., 60 per cent of the population are females and 40 per cent males).
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The main attributes or characteristics of a population residing in a given area are:-

(a) Birth rate (Natality):

It is the ratio of live births in an area to the population of an area.

It is expressed as the number of individuals added to the population with respect to the members of the population.

(b) Death rate (Mortality):

It is the ratio of deaths in an area to the population of an area.

It is expressed as the loss of individuals with respect to the members of the population.

(c) Sex ratio:

It is the number of males or females per thousand individuals.

(d) Age Distribution:

The percentage of individuals of different ages at a given population is called age distribution.

The age distribution pattern is commonly represented by age pyramids.

(e) Population density:

The number of individuals of a population present per unit area at a given time is known as population density.

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

A population grows exponentially when there is unlimited supply of food resources

Its exponential growth can be calculated by the following integral form of the exponential growth equation:

$N_t = N_o\, e^{rt}$

Where,

N_t= Population density after time t

N_O= Population density at time zero

r = Intrinsic rate of natural increase

e = Base of natural logarithms (2.71828)

From the above equation, we can calculate the intrinsic rate of increase (r) of a population.

Now, as per the question,

Present population density = x

Then,

Population density after two years = $2x$

t = 3 years

Substituting these values in the formula, we get:

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

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

Applying log on both sides:

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

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

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

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

$$\Rightarrow \frac{0.301}{1.302} = r$$

$$\Rightarrow 0.2311 = r$$

Hence, the intrinsic rate of increase for the above illustrated population is 0.2311.

7. Name important defense mechanisms in plants against herbivory.

Several plants have evolved both morphological and chemical defence mechanisms to protect themselves against herbivores.

(1) Morphological defence mechanisms:

Leaves of *Opuntia* are modified into spines which deter herbivores from feeding them.

Thorns of bougainvillea prevent herbivores from feeding them.

Sharp thorns along with leaves are present in *Acacia* to deter herbivores.

In some plants, the margins of their leaves are spiny or have sharp edges that prevent herbivores from feeding on them.

(2) Chemical defence mechanisms:

- All parts of *Calotropis* contains highly poisonous cardiac glycosides, which Prevents cattle or goats browsing on this plant.
- Chemical substances such as nicotine, caffeine, quinine, and opium produced in these plants provide defense against grazers and browsers.

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

The interaction found between an orchid growing on the branch of a mango tree is commensalism.

Orchid is an epiphyte, which grows on the branch of the mango tree takes only shelter and not nutrients. The mango tree is neither benefited nor harmed.

Hence, this kind of interaction is commensalism.

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

Predation is the ecological principle behind the biological control method of managing with pest insects.

Predation is an interaction between the prey and the predator, in which the predator feeds on the prey.

Hence, the predators regulate the population of preys in a habitat, thereby helping in the management of pest insects.

10. Distinguish between the following:

(a) Hibernation and Aestivation

(b) Ectotherms and Endotherms

(a) Hibernation and Aestivation

Hibernation	Aestivation
Hibernation is a state of reduced activity in some organisms to escape cold winter conditions. This is also known as winter sleep.	Aestivation is a state of reduced activity in some organisms to escape desiccation due to heat in summers. This is also known as summer sleep.
Bears and squirrels inhabiting cold regions are examples of animals that hibernate during winters.	**Fishes and snails** are examples of organisms aestivating during summers.

(b) Ectotherms and Endotherms

Ectotherms	Endotherms
Ectotherms are cold blooded animals. Their temperature varies with their surroundings.	Endotherms are warm blooded animals. They maintain a constant body temperature.
Fishes, amphibians, and reptiles are ectothermal animals.	Birds and mammals are endothermal animals.

11.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.

(a) Adaptations of desert plants and animals:

Adaptations of desert plants:

The extensive root system found in desert plants helps to tap underground water

Thick cuticles and sunken stomata found on the surface of the leaves reduce the rate of transpiration and avoid loss of water.

Spines of Opuntia are the modified leaves which help to reduce the loss of water.

Crassulacean Acid Metabolism (CAM) (C_4 pathway) enables the stomata to remain closed during the day to reduce the loss of water through transpiration.

Adaptations of desert animals:

kangaroo rat never drinks water in its life. It has the ability to concentrate its urine in order to conserve water.

Desert lizards and snakes bask in the sun during early morning to warm up the body.

They burrow themselves in the sand during afternoons to escape the heat of the day. Hence, they prevent the loss of water.

(b) Adaptations of plants to water scarcity

Plants found in deserts are well adapted to cope with water scarcity and scorching heat of the desert.

- Plants have an extensive root system to tap underground water.
- They bear thick cuticles and sunken stomata on the surface of their leaves to reduce transpiration.
- In *Opuntia*, the leaves are modified into spines and the process of photosynthesis is carried out by green stems.
- Desert plants have special pathways to synthesize food, called CAM (C_4 pathway).

  It enables their stomata to remain closed during the day to reduce water loss by transpiration.

(c) Behavioural adaptations in animals

Ectotherms:

The animals which do not have internal regulatory mechanism to maintain the body temperature are called ectotherms. Their temperature varies with their surroundings.

Fishes, amphibians, and reptiles are ectothermal animals.

Aestivation:

The phenomenon in which some animals remain dormant or reduce their activities during summer is called aestivation.

Some ectotherms like Fish, frog and snails undergo aestivation during summer.

Endotherms:

The animals which have internal regulatory mechanism to maintain a constant body temperature are called endotherms.

Birds and mammals are endothermal animals.

Hibernation:

The phenomenon in which some animals remain dormant or reduce their activities during winter is called hibernation.

Some endotherms like bears and squirrels inhabiting cold regions hibernate during winter.

(d) Importance of light to plants

Light is needed for photosynthesis in plants.

It is necessary for germination of seeds in certain plants.

Photoperiods determine the flowering and fruiting in plants.

Light also plays an important role in aquatic habitats for vertical distribution of plants in the sea.

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

Temperature:

Temperature affects the kinetics of enzymes and through it the basal metabolism, activity and other physiological functions of the organism.

The levels of thermal tolerance of different species determine to a large extent their geographical distribution.

Organisms which can tolerate and thrive in a wide range of temperatures are called eurythermal organisms.

Organisms which can thrive only in a narrow range of temperatures are called stenothermal organisms.

Water:

Water is necessary to **maintain turgidity** of cells.

Water acts as a **medium for chemical reactions** and transport of substances.

The **quality of water** (chemical composition, pH) becomes important for aquatic organisms.

Animals which can tolerate a wide range of salinity are called euryhaline animals.

Animals which can tolerate only a narrow range of salinity are called stenohaline animals.

12.List the various abiotic environmental factors.

All non- living components of an ecosystem forms abiotic components.

It includes factors such as temperature, water, light, and soil.

13.Give an example for:

(a) An endothermic animal

(b) An ectothermic animal

(c) An organism of benthic zone

(a) Endothermic animal:

The animals which can maintain a constant body temperature are endothermic animals. Birds such as crows, sparrows, pigeons, cranes, etc. and mammals such as bears, cows, rats, rabbits, etc. are endothermic animals.

(b) Ectothermic animal:

The animals which could not maintain a constant body temperature and whose temperature relates the surroundings are called ectothermal animals.

Fishes such as sharks, amphibians such as frogs, and reptiles such as tortoise, snakes, and lizards are ectothermic animals.

(c) Organism of benthic zone:

The bottom of the ocean floor is called benthic zone. It is the lowest ecological zone found in a water body.

Decomposing bacteria is an example of an organism found in the benthic zone of a water body.

14.Define population and community.

Population:

A population can be defined as a group of individuals of the same species residing in a particular geographical area at a particular time and functioning as a unit.

For example, all human beings living at a particular place at a particular time constitute the population of humans.

Community:

A community is defined as a group of individuals of different species, living within a certain geographical area.

Such individuals can be similar or dissimilar, but cannot reproduce with the members of other species.

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

(a) Commensalism

(b) Parasitism

(c) Camouflage

(d) Mutualism

(e) Interspecific competition

(a) Commensalism:

Commensalism is an interaction between two species in which one species gets benefited while the other remains unaffected.

An orchid growing on the branches of a mango tree and barnacles attached to the body of whales are examples of commensalisms.

(b) Parasitism:

Parasitism is an interaction between two species in which one species (usually smaller) is benefited while the other species (usually larger) is affected.

E.g. Liver fluke is a parasite that lives inside the liver of the host body and derives nutrition from it.

Hence, the parasite is benefited as it derives nutrition from the host, while the host is affected as the parasite reduces the host fitness, making its body weak.

(c) Camouflage:

Camouflage is a natural phenomenon used by plants and animals to blend with their surroundings. Predators and prey camouflage to avoid being detected.

E.g. Monarch butterfly mimics viceroy butterfly.

(d) Mutualism:

Mutualism is an interaction between two species in which both species involved are benefited.

E.g. Lichens show a symbiotic relationship between fungi and blue green algae, where both are equally benefited from each other.

(e) Interspecific competition:

It is an interaction between individuals of two different species where both the species get affected.

E.g. The competition between flamingoes and resident fishes in South American lakes for common food resources i.e., zooplankton.

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

The logistic population growth curve is commonly observed in the natural conditions when there is limited supply of food.

(a) Lag phase:

During the lag phase, the cells are metabolically active but they do not divide. The cells increase in size and adapt to the new environment.

(b) Exponential phase:

During this phase, the number of cells increase suddenly due to rapid growth.

The population grows exponentially due to the availability of sufficient food resources, constant environment, and the absence of any interspecific competition.

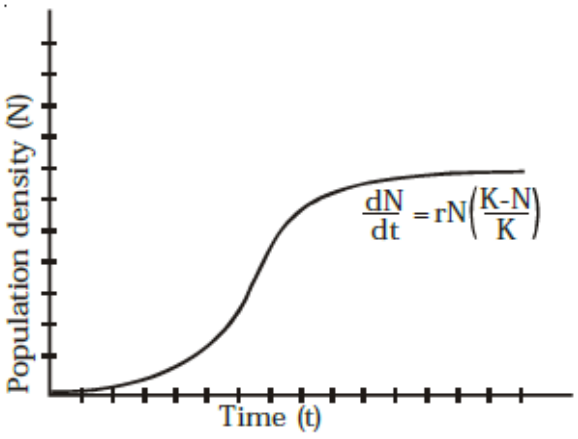
As a result, the curve rises steeply upwards.

(c) Stationary phase:

During this phase, the population becomes stable.

The number of cells produced in a population equals the number of cells that die.

The population of the species would reach nature's carrying capacity in its habitat.



(A Verhulst–pearl logistic curve is also known as an S-shaped growth curve)

$$\frac{dN}{dt} = rN\ \frac{\{K-N\}}{K}$$

Where N = Population density at time t
r = Intrinsic rate of natural increase
K = Carrying capacity

17.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, other is affected.

Ans. (d) One organism is benefited, other is affected.

Parasitism is an interaction between two species in which one species (parasite) benefited while the other species (host) is affected.

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