

Chapter 13
Organisms and Populations

1 Marks Questions

1. Which are the factor responsible for the wide variety of habitat formed within each biome?

Ans.Regional and local variations

2. Fresh water animals are unable to survive for long in sea water. Give reason.

Ans.Due to osmotic problems.

3. With which population growth model is the Verhulst Pearl equation associated?

Ans. Logistic Growth.

4. Define diapause. Which organisms exhibit it?

Ans.A stage of suspended development, zooplanktons.

5. Calculate the death rate if 6 individuals in a laboratory population of 60 fruit flies died during a particular week.

Ans. $6/60 = 0.1$ individuals per fruitfly per week.

6. In biological control method, one living organism is used against another to check its uncontrolled growth. Which kind of population interaction is involved in this?

Ans. Predation.

7. An organism has to overcome stressful condition for a limited period of time. Which strategies can it adopt to do so?

Ans.(i) Migration

(ii) Suspension of active life by hibernation/aestivation/spore formation.

8. Write what do phytophagous insects feed on?

Ans. Plant sap and other parts of plant.

9. Why do leaves contain sunken stomata?

Ans. Leaves contain sunken stomata i.e. Stomata arranged in deep pits to minimize water loss by transpiration.

10. Name the type of interaction that is detrimental to both the interaction.

Ans. Competition.

11. What type of interaction is shown by sparrows eating the seeds?

Ans. Predation.

12. Define homeostasis?

Ans. Homeostasis refers to the maintenance of a steady internal environment by organisms.

13. Give an example of suspension?

Ans. Hibernation in frogs, reptiles or polar bear.

14. What is Allen's rule?

Ans. Mammals living in colder regions have short ears & limbs to minimize heat loss.

15. "Cuckoo bird lays eggs in the nest of crow" which type of interaction is shown in this relation?

Ans. Brood parasitism.

16. Give one function of aerenchyma in aquatic plants?

Ans. Aerenchyma in aquatic plants provides buoyancy & helps them in floating.

17.What does J-shaped curve indicates?

Ans.J-shaped curve indicates that the resources are unlimited in a habitat.

18.Name the type of interaction in which one species is harmed while other is neither benefitted nor harmed?

Ans.Ammensalism.

19.Why are calotropis plants not browsed by herbivores?

Ans.Because calotropis plant produces a highly poisonous glycoside that is a cardiac poison & thus, directly kills the predator.

20.What are the two primary requirements of a parasite from host?

Ans.Food & shelter.

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

Ans.Predation, where predators prey upon pests & control their number.

22.Write the equation for verhulst - poarl logistic growth of population.

Ans. $\Delta N \Delta t = rN(K-N)$ $\Delta N \Delta t = rN(K-N)K$

23.Name the mechanism employed by ophrys to get its flowers pollinated?

Ans.Mutualism.

24.List any two factors which determine the nature of soil?

Ans.Climate & weathering process.

2 Marks Questions

1. What are the four levels of biological organisation with which ecology basically deals?

Ans. Organisms, population, communities and biomes.

2. Differentiate between stenohaline and euryhaline organisms.

Ans. Euryhaline : Organisms tolerant in wide range of salinities.

Stenohaline : Organisms tolerant to narrow range of salinities.

3. List four features which enable the Xeric plants to survive in the desert conditions.

Ans. (i) thick cuticle

(ii) Stomata in deep pits

(iii) Stomata closed during day time

(iv) leaves reduced to spines (CAM photosynthetic pathway).

4. Mention the attributes which a population has but not an individual organism.

Ans. Birth rate, Death rate, Sex ratio, age groups.

5. Differentiate between stenothermal and eurythermal organisms.

Ans. Eurythermal : Organisms that can tolerate and thrive in wide range of

temperatures Stenothermal : Organisms restricted to a narrow range of temperature.

6. What are the four ways through which the living organisms respond to abiotic factors?

Ans. (i) Regulate (ii) Conform (iii) migrate (iv) Suspend

7. Why do clown fish and sea anemone pair up? What is this relationship called?

Ans. Clown fish lives in tentacles of sea Anemone and gets protection from predators.

Interaction – commensalism.

8.Distinguish between ectotherms& Endotherms?

Ans.Ectotherms are those animals whose body temperature changes & matches with that of environment in which they are living whereas Endotherms are those animal whose body temperature is maintained relatively constant by physiological regulation.

9.“Lichens are considered good examples of obligate mutualisms”. Comment?

Ans.Lichens show an intimate mutualistic relationship between a fungus & an algae or cynobacterium where the fungus helps in absorption of nutrients & provides it to bacteria while the algae or cyanobacterium prepares the food.

10.Give any two examples of defense mechanism in plants against herbivory?

Ans. i) plants develops certain morphological means of defense e.g. thorns in bougainvillea & spines in cactus.

ii) plants produce & store certain chemicals which functions with by directly killing them or by inhibiting them from feeding .

11.What is Brood parasitism? Give an example. What adaptation has evolved in this phenomenon?

Ans.Brood parasitism refers to the phenomenon in which one bird species by its eggs in the nest of another bird species. Evolution has occurred in such a way the eggs of the parasitic birds resemble those of the host bird in size, colour etc to avoid host bird detecting the foreign eggs & ejecting them from the nest e.g. cuckoo bird lays eggs in the nest of crow. It is considered as a parasitic type of interspecific interaction because in this relationship the parasite i.e. eggs of cuckoo birds depend on crow's nest for its food & shelter but the crow is harmed because there is competition for limited food and shelter amongst the crow's egg & cuckoo's egg thus, in parasitic interspecific interaction the parasite is benefited while the host is harmed.

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

Ans.Orchids grow as epiphytes on mango tree. This is an example of commensalism in which orchids are benefited by getting a shelter while the tree is neither benefited nor harmed.

13.State Gauss's competitive exclusion principle?

Ans.Gause's competitive exclusion principle states that two closely related species competing for the same resources cannot exist together as the competitively inferior one will be eliminated but this is true only when resources are limiting & not otherwise.

14.What is migration? Why do animals show this phenomenon?

Ans.Migration is a phenomenon in which organisms can move away temporarily from the stressful conditions in the habitat with hospitable conditions e.g. birds undertake long distance migration during winter.

15.How do desert lizards maintain a fairly constant body temperature?

Ans.Desert lizards manage to deal with high temperature by keeping their body temperature fairly constant by behavioral means. They bask in the sun & absorb heat when their body temperature is below the comfort level & move into shade when it is higher.

16.Differentiate between Hibernation & aestivation?

Ans.Hibernation is the phenomenon of spending cold period in inactive stage by an animal whereas aestivation is the phenomenon of spending dry & hot conditions in an inactive stage by animal.

17.Name the kind of interaction present between the following :-

- i) Indian Nightingale & crow**
- ii) Nodulated roots & rhizobium**
- iii) Plasmodium & man**
- iv) Orchids & Mango tree**

Ans. i) Indian Nightingale & crow :- Brood parasitism

ii) Nodulated roots & rhizobium :- Mutualism

iii) Plasmodium & man :- Parasitism

iv) Orchids & Mango tree :- Commensalism.

18.Define carrying capacity?

Ans.The maximum number of individuals of a population that can be sustained by a given habitat is called its carrying capacity.

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

Ans.No, marine fish is unable to survive in a fresh water aquarium because they are adapted to live in saline sea water. They are unable to cope with outside hypotonic environment because of osmoregulation problem.

20. Out of the two population growth models, which one is more realistic & Why?

Ans. Logistic or S-shaped growth curve is more realistic because no population can continue to grow exponentially, as the resource availability becomes limiting at certain point of time.

21. What role do predators play in an ecosystem?

Ans. Predators play an important role in ecosystem :-

- i) They act as conduct for energy transfer to higher trophic level.
- ii) They keep the prey population under control which otherwise can reach very high population density.
- iii) They help in maintaining species diversity in a community.

22. Most living organisms cannot survive at temperature above 45°C. How are some microbes able to live in habitat with temperature exceeding 100°C.

Ans. Some microbes are able to live in habitats with temperature exceeding 100°C because they possess minimum amount of free water in their body. Removal of water provides resistance to high temperature.

23. Give below is a graph depicting organismic response to changing external condition. Name the type of organisms which will show:-

- i) pattern A
- ii) pattern B

Ans. i) Conformers show pattern A where body temperature changes with the ambient temperature.

ii) Regulators show pattern B where body temperature remains constant.

24. Mention any two ways in which organisms tide over unfavourable conditions by suspending their activities.

Ans. i) Hibernation – phenomenon of spending cold period in inactive stage by an animal e.g. frog, reptiles, polar bear.

ii) Aestivation – phenomenon of spending dry & hot conditions in an inactive stage by an animal e.g. snail, fishes.

25. Why are predators “prudent in nature?”

Ans. Predators are said to be prudent in nature because if a predator is too efficient &

overexploits prey, then the prey might become extinct & following it the predator will also become extinct for lack of food.

3 Marks Questions

1. How does the shape of age pyramid reflect the growth status of a population?

Ans. Shape of pyramids reflects growth status of the population (a) growing (b) Stable (c) declining.

2. Darwin showed that even a slow growing animal like elephant could reach enormous number in absence of checks. With the help of your understanding of growth models, explain when is this possible? Why is this notion unrealistic?

Ans. Possible if the growth model is Exponential, i.e., having unlimited resources. It's an unrealistic situation because resources are limited. Hence, it follows logistic growth model.

3. How will you measure population density in following cases?

(i) fish in a lake

(ii) tiger census in a national park

(iii) single huge banyan tree with large canopy .

Ans. (i) fish caught per trap.

(ii) number per unit area

(iii) percentage cover in biomass.

4. Species facing competition might evolve mechanism that promotes coexistence rather than exclusion. Justify this statement in light of Gause's competitive exclusion principle, citing suitable examples.

Ans. State Gause's competitive exclusion principle. Mechanisms are resource partitioning. E.g., experiment of MacArthur on Warblers (Refer page 325, NCERT book, Biology – XII).

5. Describe the specific adaptation of xerophytes with respect to root system, stem & leaves.

Ans. i) ADAPTATIONS IN ROOTS :- Xerophytes have well developed & extensively branched long root system. While some perennial xerophytes of succulent nature possess extensive but shallow root system. They can absorb water from dew drops & small rain droplets.

ii) ADAPTATION IN STEM:- stems of woody xerophytes are comparatively stunted hard & rigid. They may be covered with thick e.g. Acacia main stem & branches may occur as thick, fleshy, flattened & green modified structure called phylloclade.

iii) ADAPTATION IN LEAVES:- Leaves are usually short sized which decreases the chances of getting over-heated when exposed to solar radiation & thus by reducing rate of transpiration. Leaves of xerophytes are usually thick, fleshy green & leathery which are known to store water.

6. List the important characteristics of a population & Explain?

Ans. A population has following four major characteristics :-

- i) Population Density :- The size of a population in relation to a definite unit of space is termed as population density. The maximum limit of density depends upon energy flow in an ecosystem, nutritional status of trophic level & metabolic equilibrium. Population density can be mathematically calculated as : $D = N/at$ $D = N/at$
- ii) Birth Rate / Natality :- The birth rate or natality denotes the produced number of new individuals by any natural method in per unit time. The birth can be expressed by formula $B = Nnt$ $B = Nnt$
- iii) Death Rate / Mortality :- It refers to death rate of individuals in the population. It is expressed in a number of individual dying in a given period. $\text{Death Rate} = \frac{\text{no of death in population}}{\text{Time}}$ $\text{no of death in population} / \text{Time}$
- iv) Carrying Capacity:- Each habitat or ecosystem has a certain space which can accommodate a finite number of organisms depending on its size & productivity. This is called carrying capacity

7. Describe the specific adaptations of hydrophytes with respect to roots, stem & leaves?

Ans. i) ADAPTATIONS IN ROOTS:- Root system is feebly developed & unbranched some floating plants or submerged plants lack roots. Root hairs are absent except rooted floating hydrophyte. True root caps are absent.

ii) ADAPTATIONS IN STEM :- In submerged hydrophytes, stems are long slender & flexible whereas in the free-floating hydrophytes stem are modified as thick, stout, stoloniferous & occur horizontal on water surface.

iii) ADAPTATIONS IN LEAVES:- Leaves are thin, long, ribbon shaped submerged forms. In free floating plants, the petioles of leaves show indefinite power of growth.

8. Name & explain the kind of interaction in the following.

i) Algae & fungi in

ii) Head louse & humans

iii) Hermit crab & sea anemone.

Ans. i) Algae & fungi in lichens :- Lichens shows an intimate mutualistic interaction in which both fungus helps in absorption of nutrients & provides protection, while algae or

cyanobacterium prepares the food.

ii) Head louse & humans:- Head louse shows ectoparasitism on humans in which head louse is getting nutrition from human body & is thus benefited while human beings are harmed.

iii) Hermit crab & sea anemone:- Hermit crab & sea anemone shows commensalism as hermit crab is benefited because it gets protection from predators which stays away from stinging tentacles of the sea anemone.

9. Mention the different defense mechanism to reduce the impact of predation?

Ans. plant species evolved various defense mechanism to reduce impact of predation :-

- i) Certain insect species & frogs have camouflage or cryptic colouration to avoid detection by their predators.
- ii) Some animals like monarch butterfly are highly distasteful to their predators because they accumulate a certain chemical by feeding on poisonous weeds during its caterpillar stage.
- iii) Some prey are poisonous & hence are avoided by predators.
- iv) Plants have evolved certain morphological, or chemical defense mechanism against herbivores e.g. thorns in bougainvillea.
- v) plants also produce certain chemicals which functions as :-

- They make animal feel sick.
- They may inhibit them from feeding.
- They may interfere with digestion.
- They may directly kill them.

10. Mutualism often involves co-evolution of mutualists. Describe taking the example of animal plant (wasp-fig) relationship.

Ans. Plants need the help of animals for pollination their flowers & dispersing their seeds. Animals obviously have to be paid fees for the services that plants expect from them. Plants offer rewards or fees in the form of seed dispersers "plant – animal interactions often involve co-evolution of the mutualists that is, the evolution of the flower & its pollinator species can be pollinated only by its partner wasp species & no other species. The female wasp uses the fruit not only as an oviposition site but uses the developing seeds within the fruit for nourishing its larvae. The wasp pollinates the fig inflorescence while searching for suitable egg-laying sites. In return for the favors of pollination the fig offers the wasp some of its developing seeds as food for the developing wasp larvae.

11. How do kangaroo rats live in the absence of water in North American deserts?

Ans. The kangaroo rat in North American deserts is capable of meeting all its water requirement through its internal oxidation of fat, where water is by-product, it can also concentrate its urine to a minimal volume.

12. How is diapause different from hibernation?

Ans. Diapause is the phenomenon of spending unfavourable climatic conditions by insects during their development whereas. Hibernation is a phenomenon of spending the winter in a resting or dormant conditions by cold – blooded animals to escape cold by hiding them in hollow tree trunk or burrow or caves etc, revealing minimum physiological activity.

13. Study the three representative figures of age of pyramid relating to human population & answer the following question.

- i) Mention the given to the three kinds of age profile (a), (b) and (c)**
- ii) Which one of them is ideal for a population & why.**
- iii) How do such age – profile helps policy making concerned about our growing population & prepare for future generation.**

Ans. i) (a) is called young population

(b) is called stable population

(c) is called declining population

ii) Among the three, stable population is ideal because it has identical birth death rate.

iii) Age profile helps policy makers get concerned about our young population & to make an idea for future population growth so that they make future plans.

14. In the adjacent population growth curve :-

- i) What is the name given to curve (a) & (b).**
- ii) What is the status of food & space in the curve (a) & (b).**
- iii) In absence of predators, which curve “a” or “b” would appropriately depict the prey population?**
- iv) When does curve ‘b’ change into curve ‘a’.**

Ans. i) Curve (a) is known as exponential growth curve & curve (b) is known as logistic growth curve.

ii) Food & space is less in curve ‘a’ whereas plenty of food & space is available in curve ‘b’.

iii) Curve “a”.

iv) When the food resources in a given place become unlimited the curve (b) assumes an J – shape & changes into curve (a).

5 Marks Questions

1. What is altitude sickness? What its causes and symptoms? How does human

body try to overcome altitude sickness?

Ans. Breathlessness at high altitudes. Cause : Low atmospheric pressure at high altitudes due to which body does not get enough oxygen. Symptoms : Nausea, fatigue and heart palpitations.

Body adapts by :

- (a)** increasing red blood cell production
- (b)** decreasing binding affinity of haemoglobin
- (c)** by increasing breathing

2. Orchid flower, Ophrys co-evolves to maintain resemblance of its petal to female bee. Explain how and why does it do so?

Ans.

- employs 'Sexual deceit'
- one petal bears uncanny resemblance to female of the bee.
- Male bee is attracted to what it perceives as a female 'pseudocopulates,' during which pollen dusted on male bee's body.
- Male bee transfers pollen to another flower when the same bee pseudocopulates with another flower.
- Ophrys does so because pollination success will be reduced unless it co-evolves with female bee.

3. Describe the exponential growth model of a diagram along with a curve?

Ans. This kind of curve is observed in the case of under population of reindeer growing in a predator free natural environment having plenty of food. In this case, the curve formed is J-curve. The small population first takes time to adjust into new environment so there is no increase in the population. Once they get adapted they multiply exponentially. This growth & multiplication continues so far the food is available. After sometime the food supply becomes less as compared to the population increases. This causes mass starvation & mortality & results in the formation of J shaped curve.

The J-shaped growth form is described by equation

$$\Delta N/\Delta t = rN \text{ or } \Delta N/\Delta t = rN$$

4. Describe the logistic growth model of population along with a suitable curve.

Why is this curve more realistic?

Ans. The logistic growth curve shows a sigmoid or a S-shaped curve. It has three phases:-

(i) Lag-phase :- It is the early phase of little or no growth. Lag phase is one in which under population of cells adapt to or stabilise with the growth conditions before embarking upon their multiplication.

(ii) Log phase or Exponential phase :- It is the middle phase of rapid or geometric rise. Once stabilized cells start to multiply rapidly when the small population is stabilised, the multiply becomes faster because of the plenty amount of food & other requirements

of life.

(iii) Stationary phase or steady phase:- Soon after the amount of food decreases in proportion to the number of cells & this results in the onset of stationary phase. During this phase, the number of new cells produced is roughly equal to the number of cells dead & so there is no net increase in the number of cells.

Sigmoid growth curve is demonstrated by $\frac{dN}{dt} = rN \left(\frac{K-N}{K} \right)$

$\frac{dN}{dt}$ – rate of change in population ΔN – rate of change in population Δt – change in time. Δt – change in time.

K – carrying capacity

R – biotic potential

5. Give an example to show that completely unrelated species can also compete for same resources?

Ans. Completely unrelated species can also compete for same resources for e.g. In certain shallow lakes of South America the visiting flamingoes & the native fishes compete for the same zooplanktons as their food.

6. What is Age pyramid? What are the different types of age pyramid?

Ans. The geometrical diagrammatic representation of different age groups in a population of any organism is called Age of pyramids. These are of three types:-

i) Expanding pyramid:- It is a broad base, triangular pyramid which represents a population containing large number of young people. It is rapidly expanding population with high birth rate.

ii) Stable pyramid:- It represents a moderate proportion of young to old. As the rate of growth becomes slow & stable i.e. - pre-reproductive & reproductive age groups becomes more or less equal in size.

iii) Declining Pyramid:- The type of pyramid of population decreasing in size is characterised by a narrow base because there are fewer pre-reproductive individuals than in the other two age categories.