CHAPTER 13
ORGANISMS AND POPULATIONS

ONE MARK QUESTIONS:

1. Define the term, 'Ecology'.
Ecology is defined as the branch of biology that deals with the study of interaction among organisms and between the organism and its physical (abiotic) environment.

2. What is the main reason for creation of seasons?
Rotation of sun and the tilt of its axis cause annual variations in the intensity and duration of temperature, resulting distinct seasons.

3. Mention the factors that account for the formation of major biomes in the earth.
Annual variations in the intensity and duration of temperature along with annual variations in precipitation are responsible for the formation of major biomes.

4. Give an example for biome.
Desert biome/Tundra biome/Rainforest biome

5. Why light is considered as an important abiotic factor for animals?
Animals use diurnal and seasonal variations in light intensity and photoperiod as cues for timing their foraging, reproductive and migration.

6. Define the term, Homeostasis.
Homeostasis is the process by which the organisms maintain a constant internal environment in respect to changing external environment.

7. Define the term, Regulate.
Some organisms are able to maintain homeostasis by physiological (sometimes behavioral also) means which ensures constant body temperature, constant osmotic concentration. This is called Regulate.

8. What feature of a mammal is largely responsible for their "success" in either the environmental conditions of Antarctica or Sahara desert?
Thermoregulation.

9. The smaller animals are rarely found in Polar Regions. Give reason.
Small animals have larger surface area relative to their volume, they tend to lose body heat very fast when it is cold outside and hence they have to expend much energy to generate body heat through metabolism.

10. What is migration?
The organism can move away temporarily from the stressful habitats to a more hospitable area and return when stressful period is over. This is called migration.

11. The species that can tolerate narrow range of temperatures are called what?
Stenothermal

12. What is dormancy?
Dormancy is a stage during which the organisms reduce their metabolic activity become inactive.

13. What is hibernation?

Hibernation is a process by which the animals like bear avoid the stress and become inactive during winter.

14. What is aestivation?

Aestivation is a process by which the animals like snails and fishes avoid the stress and summer related problems like heat and desiccation and become inactive during summer.

15. What is diapause?

It is a stage of suspended development seen in many zooplanktons to avoid unfavorable conditions.

16. "In animals, the organism, if unable to migrate, might avoid the stress by escaping in time". Justify the statement by giving one example.

1. Bears going into hibernation during winter.

OR

2. Snails and fishes going into aestivation in summer.

OR

3. Many Zooplankton species undergoing a stage of suspended development called diapause.

17. What is adaptation?

Adaptation is any attribute of the organism (morphological, physiological, and behavioral) that enables the organism to survive and reproduce in its habitat

18. Define the term, "population".

Population can be defined as a group of individual living in a well defined geographical area, share or compete for similar resources, potentially interbreed.

19. What is an age pyramid?

It is the graphical representation of population of an area at a given time, in which percentage of individuals of an age group is plotted for the population.

20. What does the age pyramid reflects?

It shows whether the population is growing or stable or decreasing.

21. What is population density?

The size of the population in numbers of a given area.

22. What is Allen's rule?

Allen's rule states that those animals, e.g., mammals from colder climates generally have shorter ears and limbs to minimize heat loss.

23. Give an example for Allen's rule.

Seals of polar aquatic seas have a thick layer of fat called blubber below their skin that acts as insulator and reduces loss of body heat.

24. Why the seals of polar aquatic seas posses a thick layer of fat below the skin?

It is an adaptation to reduce loss of body and also acts as insulator.

25. Why body develops nausea, fatigue and heart palpitations when a person move to high altitude (>3,500 meter)?

This is due to low atmospheric pressure of high altitudes; the body does not get enough oxygen.

26. Mention any one behavioral adaptation observed in animals.

Some species burrowing into the soil to hide and escape from the above-ground heat.

27. Define population.

A group of individual living in a well defined geographical area, share or compete for similar resources, potentially interbreed is called population.

28. What is an age pyramid?

The graphical representation derived when the age distribution is plotted for a population the resulting structure is called age pyramid.

29. What is the letter used to designate population density?

N

30. List the methods used to estimate population size during tiger census recently.

Pug marks and fecal pellets for tiger census.

31. Define Natality.

Natality refers to the number of birth in given period in the population.

32. Define Mortality

Mortality refers to the number of deaths in the population in a given period of time.

33. Define Birth rate

The birth rate is the total number of births per 1000 of a population each year

34. Define death rate

Mortality rate is a measure of the number of deaths (in general, or due to a specific cause) in a population, scaled to the size of that population, per unit of time.

35. Define Immigration

Immigration refers to the number of individuals of same species that have come into the habitat from elsewhere during a given period of time.

36. Define emigration.

Emigration refers to the number of individuals of the population who left the habitat and gone elsewhere during a given time period.

37. Mention the significance of the study of population ecology.

Population ecology is an important area of ecology because it links ecology to population genetics and evolution.

38. "Although total number is generally the most appropriate measure of population density, it is in some cases either meaningless or difficult to determine. What is the alternative method?

In such cases, the per cent cover or biomass is a more meaningful measure of the population size.

39. if N is the population density at time t, mention the formula to show its density at time t +1.

$N_{t+1} = N_t + [(B + I) - (D + E)]$

40. Mention the formula to express exponential growth.

$dN/dt = rN$

41. In the formula dN/dt = rN, 'r" represents what?

'r' represents 'intrinsic rate of natural increase'.

42. Write the equation for describing the Verhulst-Pearl Logistic Growth

$dN/dt = rN (K-N / N)$

43.What is Carrying capacity?

The maximum population size that an environment can sustain is called carrying capacity.

44. What are the factors that govern of logistic growth?
A population growing in a habitat with limited resources, then logistic growth curve is obtained.

45. Define the term "competition" in terms of ecological interaction.
Competition is best defined as a process in which the fitness of one species (measured in terms of its 'r' the intrinsic rate of increase) is significantly lower in the presence of another species

46. "Totally unrelated species could also compete for the same resource". Give an example.
In some shallow South American lakes visiting flamingoes and resident fishes compete for their common food, the zooplankton in the lake.

47. Resources need not be limiting for competition to occur". Give an example.
In interference competition, the feeding efficiency of one species might be reduced due to the interfering and inhibitory presence of the other species, even if resources (food and space) are abundant.

48. When resources are limited the competitively superior species will eventually eliminate the other species". Substantiate this with an example.
The Abingdon tortoise in Galapagos Islands became extinct within a decade after goats were introduced on the island, apparently due to the greater browsing efficiency of the goats.

49. What is competitive release?
"A species, whose distribution is restricted to a small geographical area because of the presence of a competitively superior species, is found to expand its distributional range dramatically when the competing species is experimentally removed.

50. State Gause's 'Competitive Exclusion Principle'.
Gause's 'Competitive Exclusion Principle 'states that two closely related species competing for the same resources cannot co-exist indefinitely and the competitively inferior one will be eliminated eventually.

43. What is 'resource partitioning'?
If two species compete for the same resource, they could avoid competition by choosing, for instance, different times for feeding or different foraging patterns. This is called resource partitioning.

51. What is commensalism?
This is the interaction in which one species benefits and the other is neither harmed nor benefited.

52. Give an example for commensalism.
An orchid growing as an epiphyte on a mango branch
OR
Barnacles growing on the back of a whale.
OR
The cattle egret and grazing cattle.
OR
Sea anemone that has stinging tentacles and the clown fish that lives among them

53. What is mutualism?
This interaction confers benefits on both the interacting species/both the organisms are benefited.

54. Give an example for mutualism.
Lichens represent an intimate mutualistic relationship between a fungus and photosynthesising algae or cyanobacteria.
OR
The mycorrhizae are associations between fungi and the roots of higher plant.
55. Give an example for mutualism as a plant-animal interaction.
Animals pollinating their flowers and dispersing their seeds.
56. Give an example for "tight one-to-one relationship with the pollinator" in mutualism.
Fig trees and the pollinator species of wasp.
57. What is the meaning of "carrying capacity"?
In nature, a given habitat has enough resources to support a maximum possible number, beyond which no further growth is possible
58. What is commensalism?
The interaction where one species is benefitted and the other is neither benefitted nor harmed is called commensalism.
59. What is ammensalism?
In amensalism on the other hand one species is harmed whereas the other is unaffected.
60. "Certain exotic species are introduced into a geographical area, they become invasive and start spreading fast because the invaded land does not have its natural predators". Substantiate this with one example.
The prickly pear cactus introduced into Australia in the early 1920's caused havoc by spreading rapidly into millions of hectares of rangeland.
61. How the highly invasive prickly pear cactus was controlled in Australia in early 1920's?
By introducing the cactus-feeding predator (a moth) from its natural habitat into the country.
62. In mutualism, how the two different organisms in mycorrhizae gets benefited?
The fungi help the plant in the absorption of essential nutrients from the soil while the plant in turn provides the fungi with energy-yielding carbohydrates.
63. An orchid plant is growing on a mango tree. How do you describe the interaction between the orchid and the mango tree? 1
Commensalisms, In this interaction the orchid is benefitted on attaining the support whereas, mango tree is neither benefitted nor harmed.
64. Cattle or goats never graze on weeds of calotropis. Give reasons.
The plant produces highly poisonous cardiac glycosides.
65. 'Two closely related species competing for the same resources cannot co-exist indefinitely'. State the principle which supports this phenomenon.
Gause's competitive exclusion principle
66. What type of growth status the following pyramid represents

Declining population

67. "Abingdon tortoise in Galapagos islands became extinct within a decade after goats were introduced in that island". Can you cite the possible reason for the same?

Goats have greater browsing efficiency and hence the tortoises died of lack of food.

68. If a marine fish is placed in fresh water aquarium, will the fish be able to survive? Why?

No, it will not survive in fresh water aquarium because of osmotic problem it would face.

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

Regional and local variations

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

Due to osmotic problems.

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

Logistic Growth.

72. Define diapause.

A stage of suspended development,

73. Name the group of organisms that exhibit diapause.

zooplanktons.

74. 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?

Predation.

75. Why thermoregulation is more effectively achieved in larger animals than in smaller ones?

Because, thermoregulation is a function of surface area. larger animals possess larger surface area and so they can achieve thermoregulation easily when compared to smaller animals.;

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

6/60 =0.1 individuals per fruit fly per week

77. Very small animals like shrews and humming birds are rarely found in Polar Regions. Why?

They have large surface area relative to their volume so lose body heat very fast in colder regions. Hence, occur rarely in polar region.

78. Write what do phytophagous insects feed on?

Plant sap and other parts of plant..

79. Why are the Polar Regions not a suitable habitat for tiny humming birds?

When volume is considered surface area is large, loss of heat is more in cooler areas/difficult to generate more heat.

80. What is sex ratio?

The ratio between male female in a population

2 MARK QUESTIONS:
1. Most living organisms cannot survive at temperatures above 45°c. How are some microbes able to live in habitats with temperature beyond 100°c?

Microbes posses physiological and biochemical adaptations which allow them to live in habitats with temperature exceeding. 100°c. There are branched chain lipids in the cell membrane and special resistant enzymes which deal with high temperatures.

2. People living in higher altitudes have higher RBC count. Give reasons

Due to low atmospheric pressure at higher attitudes body compensates low oxygen availability by increasing red blood cell production, decreasing the binding affinity of hemoglobin and by increasing breathing rate.

3. Write a note on temperature as abiotic factor.

Temperature is the most ecologically relevant ecological factor.

Temperature affects the kinetics of enzymes, BMR (Basic Metabolic Rate) and other physiological actions in organisms.

Eurythermal: A few organisms which can tolerate wide range of temperatures. They are called eurythermal organisms.

Stenothermal: Many organisms which can tolerate narrow range of temperatures are called stenothermal organisms.

4. Write a note on water as abiotic factor.

Life is originated in water and it is unsustainable without water.

The productivity and distribution of plants is also heavily dependent on water.

For aquatic organisms, the quality (chemical composition, pH) is very important.

Euryhaline: The organisms which can tolerate wide range of salinity are called euryhaline organisms.

Stenohaline: The organisms which can tolerate narrow range of salinity stenohaline organisms.

5. Explain the mechanism by which humans regulate their body temperature.

We maintain a constant body temperature of 37oC.

When outside temperature is high we sweat profusely and evaporative cooling take place to bring body temperature down.

In winter due to low temperature outside our body temperature falls below 37oC, we start to shiver, to generate heat to raise body temperature.

6. Write a note on Conformers.

Majority (99%) of animals and plants cannot maintain a constant internal environment and hence their body temperature varies according to ambient temperature.

In aquatic animals the osmotic concentration of body fluid varies with ambient water osmotic concentration. Such animals and plants are simply called as conformers.

7. Write a note on migration.

The organism can move away temporarily from the stressful habitat to a more hospitable area and return when stressful period is over. This is called migration.

Many animals, particularly birds, during winter undertake long-distance migrations to more hospitable areas.

Every winter the famous Keolado National Park (Bharatpur) in Rajasthan host thousands of migratory birds coming from Siberia and other extremely cold northern regions.

8. Write a note on suspend.

In bacteria, fungi and lower plants, various kinds of thick walled spores are formed which help them to survive unfavorable conditions – these germinate on availability of suitable environment.

In higher plants, seeds and some other vegetative reproductive structures serve as means to tide over periods of stress besides helping in dispersal.

They germinate to form new plants under favorable moisture and temperature conditions. They do so by reducing their metabolic activity and going into a state of **'dormancy'.**

9. How is kangaroo rat adapted for lack of external source of water?

Kangaroo rat meets their water requirement from oxidation of fat, in which water is a byproduct.

They excrete very concentrate urine to conserve water.

10. List the adaptation seen in animals for cold climate.

Mammals from colder climates generally have shorter ears and limbs to minimize heat loss. This is called Allen's Rule.

Seals of polar aquatic seas have a thick layer of fat called blubber below their skin that acts as insulator and reduces loss of body heat

11. How the body of humans gets adapted for high altitudes?

The body compensates low oxygen availability by increasing red blood cell production.

The body compensates decreasing binding capacity of hemoglobin with oxygen by increasing rate of breathing.

12. "Desert lizards are conformer hence they cope with the stressful environment by behavioral adaptations". How?

They bask in the sun and absorb heat when their body temperature drops below the comfort zone in winter.

They move to shade when the ambient temperature starts increasing

13. Mention any two attributes that as individual organism does not have but shown by a population.

Birth rate, Death rate and sex ratio.

14. List the methods used to estimate population size.

Counting the number

Percent cover estimation.

Biomass estimation.

Counting Pug marks and fecal pellets for tiger census

15. Write a note on Allen's rule.

Allen's Rule states that animals i.e., mammals from colder climates generally have shorter ears and limbs to minimize heat loss.

Seals of polar aquatic seas have a thick layer of fat called blubber below their skin that acts as insulator and reduces loss of body heat.

16. What are the symptoms of altitude sickness?

Symptoms developed are nausea, fatigue and heart palpitations.

17. How the body solves the problem of Altitude sicknes?

The body compensates low oxygen availability by increasing red blood cell production.

The body compensates decreasing binding capacity of hemoglobin with oxygen by increasing rate of breathing.

18. How the desert lizards cope with the stressful environment by behavioral adaptations?

They bask in the sun and absorb heat when their body temperature drops below the comfort zone in winter.

They move to shade when the ambient temperature starts increasing.

19. In a pond there are 20 lotus plants last year and through reproduction 8 new plants are added, taking the current population to 28, calculate the birth rate.

8/20 = 0.4 offspring per lotus per year.

20. If 4 individuals in a laboratory population of 40 fruit flies died during a specified time interval, say a week, calculate the death rate in the population during that period.

4/40 = 0.1 individuals per fruit fly per week.

21. Mention the characteristic features of age pyramid.

1. The age pyramids generally show age distribution of males and females in a combined diagram.

2. The shape of the pyramids reflects the growth status of the population - (a) whether it is growing, (b) stable or (c) declining.

22. Give the diagrammatic representation of an expanding age pyramid.
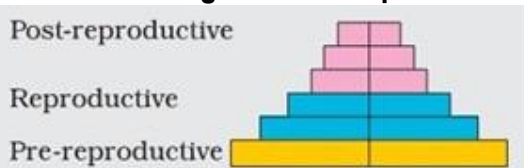
23. Give the diagrammatic representation of a stable age pyramid.

24. Give the diagrammatic representation of a declining age pyramid.

25. What are the observations one can make from the study of population?

1. The outcome of competition with another species.

2. The impact of a Predator or the effect of a pesticide application.

26. "Although total number is generally the most appropriate measure of population density, it is in some cases either meaningless or difficult to determine."Justify with an example.

For example, in an area, if there are 200 *Parthenium* plants but only a single huge banyan tree with a large canopy, stating that the population density of banyan is low relative to that of *Parthenium* amounts to underestimating the enormous role of the Banyan in that community.

27. Mention the four basic processes, becase of which density of a population in a given habitat during a given period, fluctuates.

Natality, Mortality, Immigration, Emmigration.

28. Give the 'r" value (intrinsic rate of natural increase) value for Humans (in 1981) and Norway rat.

For the Norway rat the r is 0.015, and for the flour beetle it is 0.12.

In 1981, the r value for human population in India was 0.0205.

29. Mention the characteristic of exponential growth.

When resources in the habitat are unlimited, each species has the ability to realize fully its innate potential to grow in number and shows exponential growth.

Any species growing exponentially under unlimited resource conditions can reach enormous population densities in a short time.

30. If in a population of size N, the birth rates represented as b and death rates as d, then derive the formula to calculate the increase or decrease in N during a unit time period t (dN/dt).

$dN/dt = (b - d) \times N$

Let $(b-d) = r$, then

$dN/dt = rN$.

31. Explain the characteristic features of a population showing logistic growth?

A population growing in a habitat with limited resources show initially a lag phase, followed by phases of acceleration and deceleration and finally an asymptote, when the population density reaches the carrying capacity.

32. Explain Cornell's experiment.

Connell's elegant field experiment showed that superior barnacle *Balanus* dominates the intertidal area and excludes the smaller barnacle *Chathamalus* from that zone.

33. Explain the experiment of MacArthur to show resource partitioning.

MacArthur showed that five closely related species of warblers living on the same tree were able to avoid competition and co-exist due to behavioral differences in their foraging activities. Explain the different adaptations of parasites.

34. Write a note on brood parasitism.

Brood parasitism in birds is fascinating example of parasitism in which the parasitic bird lays its eggs in the nest of its host and lets the host incubate them.

During the course of evolution, the eggs of the parasitic bird have evolved to resemble the host's egg in size and color to reduce the chances of the host bird detecting the foreign eggs and ejecting them from the nest.

35. Explain mutualism taking the interaction between fig trees and wasp as an example.

A given fig species can be pollinated only by its 'partner' wasp species and no other species. The female wasp uses the fruit not only as an oviposition (egg-laying) 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 favor of pollination the fig offers the wasp some of its devloping seeds, as food for the developing wasp larvae.

36. Predators also help in maintaining species diversity in a community, by reducing the intensity of competition among competing prey species". Give an example.

In the rocky intertidal communities of the American Pacific Coast the starfish Pisaster is an important predator.

In a field experiment, when all the starfish were removed from an enclosed intertidal area, more than 10 species of invertebrates became extinct within a year, because of inter-specific competition.

37. How monarch butterfly survives from its predator?

The Monarch butterfly is highly distasteful to its predator (bird) because of a special chemical present in its body.

Interestingly, the butterfly acquires this chemical during its caterpillar stage by feeding on a poisonous weed.

38. Kangaroo rats can survive in the absence of an external source of water. How do they adapt themselves to such conditions?

Kangaroo rat is capable of meeting its entire water requirement through its internal fat oxidation in which water is a by -product. It has the ability to concentrate urine.

39. Small animals are rarely found in Polar Regions. Give reasons.

Smaller animals tend to lose more body heat due to large surface area relative to their volume. Therefore, they have to spend more energy to generate body heat.

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

(i) Migration

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

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

This is the interaction in which clown fish species benefits and the sea anemone is neither benefited nor harmed.

Commensalism.

42. Why are the small birds like humming birds are not found in Polar Regions?

Thermoregulation is energetically expensive for many organisms and this is particularly true for small animals like shrews and humming birds.

43. State two important defense mechanisms in plants against herbivory, with an example each.

Plants have evolved an astonishing variety of morphological and chemical defenses against herbivores.

Thorns (Acacia, Cactus) are the most common morphological means of defence.

Many plants produce and store chemicals that make the herbivore sick when they are eaten, inhibit feeding or digestion, disrupt its reproduction or even kill it.

The weed *Calotropis* growing in abandoned fields. The plant produces highly poisonous cardiac glycosides and that is why you never see any cattle or goats browsing on this plant.

A wide variety of chemical substances that we extract from plants on a commercial scale (nicotine, caffeine, quinine, strychnine, opium, etc.,) are produced by them actually as defenses against grazers and browsers

44. Some organisms suspend their metabolic activities to survive in unfavourable conditions. Explain with the help of four examples.

Thick walled spores are formed in microbes to overcome unfavorable stressful external environment. Spores germinate in favorable condition.

In higher plants seeds and other vegetative reproductive structures are means to tide over the stress. They reduce their metabolic activity and going into a state of 'dormancy'.

Hibernation: during winter animals like bears escape in time

Aestivation: animals like snail and fish avoid summer related problem like heat and desiccation.

Diapause: many zooplanktons undergo a stage of suspended development in unfavourable conditions.

45. Why are herbivores considered similar to predators in the ecological context? Explain.

Transfer of energy fixed by plants to the next trophic level - carnivores,

Maintain the plant population under control = ½ + ½

46. "Snow leopards are not found in Kerala forests and tuna fish are rarely found beyond tropical latitude in the ocean". Study the above two cases and states the possible reasons for the same.

Change in temperature from their established habitats affects the kinetics of the enzymes and through it the basal metabolism, activity and other physiological functions of the organism.

47. How do the increase and the decrease in the value of 'r' affect the population size?

The value of 'r" is affected by increase or decrease in birth rates and death rates.

48. When and why do some animals like snails undergo aestivations?

Summer

To survive from heat/to avoid dessication.

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

Organisms, population, communities and biomes.

50. Differentiate between stenohaline and euryhaline organisms.

Euryhaline: Organisms tolerant in wide range of salinities.

Stenohaline: Organisms tolerant to narrow range of salinities.

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

(i) Thick cuticle

(ii) Stomata in deep pits

(iii) Stomata closed during day time

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

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

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

53. Differentiate between stenothermal and eurythermal organisms.

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

Stenothermal: Organisms restricted to a narrow range of temperature.

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

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

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

Clown fish lives in tentacles of sea Anemone and gets protection from predators. Interaction – commensalism.

56. What does S-Shaped pattern of population growth represent? How is J-shaped pattern different from it and why?

S shaped pattern is represents:

S shaped growth represents

A kind of growth when responses are limiting the Growth.

Resources for growth for most animal populations are finite and become limiting.

The logistic growth model is a more realistic one.

J shaped pattern represents a kind of growth when the resources are not limiting, where as the S shaped curve represents when resources are limiting the Growth.

57. Bear hibernates whereas some species of zooplankton enter diapause to avoid stressful external conditions. How are these two ways different from each other?

Bears suppress their metabolic activity in winter and avoid stressful conditions in winter, where as zooplanktons suspend their development during unfavorable conditions.

3 MARKS QUESTIONS

1. Write a note on the importance of light as abiotic factor for plants.

Plants produce food by photosynthesis, which is possible only in the presence of light. Hence it is very important for autotrophs.

Plant species (herbs and shrubs) adapted for photosynthesize optimally under low light conditions because they are constantly overshadowed by tall canopied trees.

Sunlight is required for photoperiodic response like flowering in plants.

2. Write a note on soil as abiotic factor.

Properties of soil vary according to the climate, the weathering process.

Soil composition, grain size and aggregation determine the percolation and water holding capacity of the soil.

These characteristic along with pH, mineral composition and topography determine to a large extent the vegetation in any area. This in turn dictates the type of animals that can be supported.

The sediment-characteristic often determine the type of benthic animal in aquatic environment.

3. "The conformer had not evolved to become regulators". Justify the statement.

Thermoregulation is energetically expensive for many animals.

Small animal like shrews and humming birds cannot afford so much energy for thermoregulation.

Heat loss or heat gain is a function of surface area.

Small animals have larger surface area relative to their volume. They tend to lose body heat very fast when it is cold outside. Then they have to expend much energy to generate body heat through metabolism.

4. Describe the adaptation of desert plants.

The presence of thick cuticle on their leaf surfaces.

The presence of sunken stomata to reduce transpiration.

They have special photosynthetic pathway (CAM), in which stomata closed during day time and remained open during night.

Desert plants like Opuntia have no leaves and they are reduced to spines.

In such plants,photosynthesis takes place in flat green stems

5. How behavioral responses are achieved by animals during variation in the environment?

Desert lizards are conformer hence they cope with the stressful environment by behavioral adaptations:

They bask in the sun and absorb heat when their body temperature drops below the comfort zone in winter.

They move to shade when the ambient temperature starts increasing.

Some species burrowing into the soil to hide and escape from the above-ground heat.

6. What is the significant of age pyramids? List the different types of age pyramids.

The shape of the pyramids reflects the growth status of the population.For example **growing, stable** or **declining population.**

7. Population size, more technically called population density (designated as N), need not necessarily be measured in numbers only. Explain the reasons for this with examples.

If the population is huge and counting is impossible or very time-consuming. If you have a dense laboratory culture of bacteria in a Petri dish what is the best measure to report its density for certain ecological investigations, there is no need to know the absolute population densities; relative densities serve the purpose equally well.

For example, the number of fish caught per trap is good enough measure of its total population density in the lake.

For example, the tiger census in our national parks and tiger reserves is often based on pug marks and fecal pellets.

8. Mention factors that keeps the population size changing in time.

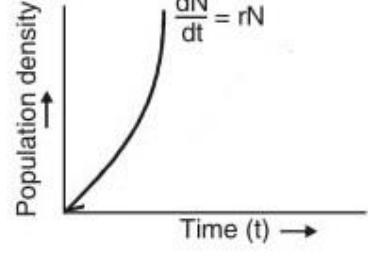Food availability, predation pressure and adverse weather.

9. In the equation, dN/dt = rN (K–N / N), r,K,N stand for what?
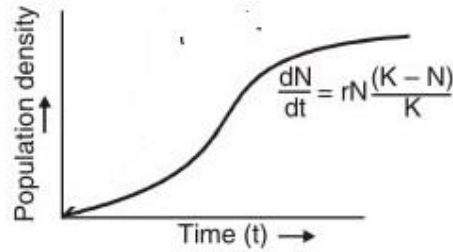
N = Population density at time t

r = Intrinsic rate of natural increase

K = Carrying capacity.

10. Graphically represent the exponential growth curve with the equation.

11. Graphically represent the logistic growth curve with the equation.

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

12. Differentiate between exponential growth and logistic growth.

exponential growth	logistic growth
1. When resources are not limiting the growth.	1. When responses are limiting the Growth.
2. Any species growth exponentially under unlimited resources conditions can reach enormous population densities in a short time.	2. Resources for growth for most animal populations are finite and become limiting.
3. Growth is not so realistic	3. The logistic growth model is a more realistic one

13. List the defense developed by prey against predator in animal communities.

Insects and frogs are cryptically colored (camouflaged) to avoid being detected by the predator. Some are poisonous and therefore avoided by the predators.

Monarch butterfly is highly distasteful to its predator (bird) due to presence of special chemical it its body. The chemical acquired by feeding a poisonous weed during caterpillar stage.

14. List the defense developed by prey against predator in animal communities.

Thorns in Acacia, Cactus are morphological means of defense.

Many plants produce and store some chemical which make the herbivore sick if eaten, inhibit feeding, digestion disrupt reproduction, even kill the predators.

Calotropis produces poisonous cardiac glycosides against herbivores.

Nicotine, caffeine, quinine, strychnine, opium etc. are produced by plant actually as defenses against the grazers and browsers.

15. What are ectoparasites? Give any four examples for ectoparasites.

Ectoparasites are those organisms that feed on the external surface of the host.

Lice on human

Ticks on dog

Marine fish infested with copepods

Cuscuta, a parasitic plant that grow on hedge plants.

16. How do organisms cope with stressful environmental conditions which are localized or of short duration?

Migrate temporarily from the stressful habitat to a hospitable area / suspended activities / Form thick walled spores / Form dormant seeds / Hibernate during winter / Aestivate during summer / Planktons diapause (Any four)

17. How does the floral pattern of Mediterranean orchid Ophrys guarantee cross pollination?

One petal of *Ophrys* resembles the female of a bee, male bees are attracted to it / perceives it as female, pseudocopulates, same male bee pseudocopulates with another flower of *Ophrys* and pollination is completed.

18. How do organisms like fungi, zooplanktons and bears overcome the temporary short-lived climatic stressful conditions? Explain.

Fungi - produce thick walled spores to survive unfavorable condition

Zooplanktons - diapause to suspend development

Bear – undergo hibernation in winter

19. How does our body adapt to low oxygen availability at high attitudes?

Increased RBC production

Decreasing binding capacity of haemoglobin

Increasing breathing rate

20. Why are small animals rarely found in Polar Regions?

Heat loss or heat gain is a function of surface area

Small animals – large surface area relative to volume

Lose body heat fast – have to expend more energy through metabolism

21. How do organisms cope with stressful external environmental conditions which are localized or for short duration?

If the stressful external environmental conditions which are localized or for short duration, the animals have two options.

Migrate: The organism can move away temporarily from the stressful habitat to a more hospitable area and return when stressful period is over. In human analogy, this strategy is like a person moving from Delhi to Shimla for the duration of summer. Many animals, particularly birds, during winter undertake long-distance migrations to more hospitable areas. Every winter the famous Keolado National Park (Bharatpur) in Rajasthan host thousands of migratory birds coming from Siberia and other extremely cold northern regions.

Suspend: In bacteria, fungi and lower plants, various kinds of thick-walled spores are formed which help them to survive unfavourable conditions – these germinate on availability of suitable environment. In higher plants, seeds and some other vegetative reproductive structures serve as means to tide over periods of stress besides helping in dispersal – they germinate to form new plants under favourable moisture and temperature conditions. They do so by reducing their metabolic activity and going into a state of 'dormancy'

22. Mr. Ram on a trip to Rohtang Pass Suddenly experienced heart Palpitations, Nausea, fatigue etc on reaching the destination. Suggest the reasons for his sudden deterioration of health and also state Whether his body will withstand this problem if he stays there for long and how?

1) Atmospheric pressure in Rohtang pass, which is at high altitude, is low and hence the body does not get enough oxygen. Ram is suffering from altitude sickness. 1+1

If he stays for long the following change will occur in the body and he will become acclimatised to the conditions. 1

a) RBC production increases

b) Breathing rate increases

c) Binding capacity of hemoglobin decreases.

23. Anand on a visit through an under the ocean aquarium found that many sea anemones are attached to hermit crab shells, sucker fisher attached to the ventral surface of sharks and clown fish living among the sea anemones. He wondered whether all these associations are of the same type; can you help him to arrive at the correct conclusion. 3

a) Relation between sea anemones and hermit crab is mutualism since sea anemones protects the hermit crab and crab provides bits of food to sea anemone, thus both benefitted. 1

b) Relation between shark and suckerfish is commensalisms because only sucker fish gets food and is benefitted while shark is neither harmed nor benefitted. 1

c) Relation between sea anemone and clown fish is also commensalism since only the fish gets protection from predators.

24. 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?

Possible if the growth model is Exponential, i.e., having unlimited resources.

It is an unrealistic situation because resources are limited. Hence, it follows logistic growth model.

25. 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.

(a) Fish caught per trap.

(b) Number per unit area

(c) Percentage covers in biomass.

26. List the characteristic features of endoparasites.

Life cycle is more complex in endoparasites.

Morphological and anatomical features are greatly simplified.

Highly developed reproductive system.

27.Explain brood parasitism with the help of an example.

Brood parasitism in birds is fascinating examples of parasitism in which the parasitic bird lays its eggs in the nest of its host and lets the host incubate them. During the course of evolution, the eggs of the parasitic bird have evolved to resemble the host's egg in size and color to reduce the chances of the host bird detecting the foreign eggs and ejecting them from the nest. Try to follow the movements of the cuckoo (koel) and the crow in your neighborhood park during the breeding season (spring to summer) and watch brood parasitism in action

5 MARK QUESTIONS

1. Explain Physiological adaptation to high altitude by humans. How the bodies solve the problem?

Adaptation in high altitude:

A person move to high altitude (>3,500 meter), develop altitude sickness.

Symptoms developed are nausea, fatigue and heart palpitations.

This is due to low atmospheric pressure of high altitudes; the body does not get enough oxygen.

The body compensates low oxygen availability by increasing red blood cell production.
The body compensates decreasing binding capacity of hemoglobin with oxygen by increasing rate of breathing.

2. Explain Different strategies developed by animals to escape in time.
In animals, the organism, if unable to migrate, might avoid the stress by escaping in time.
The familiar case of bears going into hibernation during winter is an example of escape in time.
Some snails and fish go into aestivation to avoid summer–related problems-heat and desiccation. Under unfavorable conditions many zooplankton species in lakes and ponds are known to enter diapause, a stage of suspended development

3.Explain different Adaptation of plants and animals for dry conditions.
Adaptation of animal in desert:
Kangaroo rat meets their water requirement from oxidation of fat.
Excrete very concentrate urine to conserve water.
Adaptation of plant in desert (xerophytes)
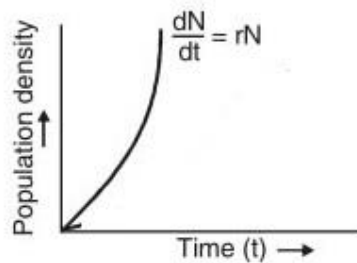Thick cuticle on their leaf surfaces.
Sunken stomata, both to reduce transpiration.
Have special photosynthetic pathway (CAM), stomata closed during day time and remained open during night.
Opuntia has no leaf- they are reduced to spines.
Photosynthesis takes place in flat green stems.

4. Explain Exponential growth and its characteristics.

Exponential growth:
The Exponential growth equation is $N_t = N_0 e^{rt}$
N_t = Population density after time t
N_0 = Population density at time zero
r = intrinsic rate of natural increase
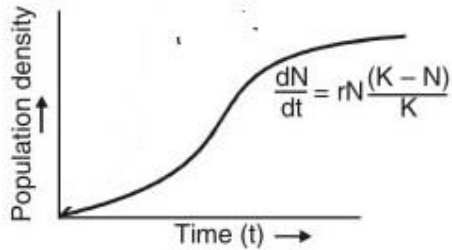e = the base of natural logarithms (2.71828)
Exponential growth ('J' shape curve is obtained).
When resources are not limiting the growth.
Any species growth exponentially under unlimited resources conditions can reach enormous population densities in a short time.
Growth is not so realistic.

5. Explain Logistic growth and its characteristics..

Verhulst-Pearl Logistic Growth is described by the following equations

dN/dt = rN (K–N / N)

Where N = Population density at time t

r = Intrinsic rate of natural increase

K = Carrying capacity

Logistic Growth (Sigmoid curve is obtained)

When resources are limiting the Growth.

Resources for growth for most animal populations are finite and become limiting.

The logistic growth model is a more realistic one.

6. What is predation? Explain the characteristic of predation.

Organism of higher trophic level (predator) feeds on organism of lower trophic level (prey) is called the predation.

Even the herbivores are not very different from predator.

Predator acts as a passage for transfer of energy across trophic level.

Predators keep prey populations under control.

If exotic species have no natural predator hence they grow very rapidly. (E.g.,Prickly pear cactus introduced in Australia created problem)

Predators also help in maintaining species diversity in a community, by reducing the intensity of competition among competing prey species. (Pisaster starfish field experiment).

7. Describe the adaptation of parasites.

Loss of unnecessary sense organs.

Presence of adhesive organs or suckers to cling on to the host.

Loss of digestive system.

High reproductive capacity

Parasites having one or more intermediate host or vectors to facilitate parasitisation of its primary host.

Liver fluke has two intermediate hosts (snail and a fish) to complete its live cycle.

The malaria parasite needs a vector{mosquito} to complete its life cycle.

8. Explain the pollination in Mediterranean orchid *Ophrys* and its significance in the process of co-evolution.

The Mediterranean orchid *Ophrys* employs 'sexual deceit' to get pollination done by a species of bee. One petal of its flower bears an uncanny resemblance to the female of the bee in size, color and markings.

The male bee is attracted to what it perceives as a female, 'pseudocopulates' with the flower, and during that process is dusted with pollen from the flower.

When this same bee 'pseudocopulates' with another flower, it transfers pollen to it and thus, pollinates the flower.

This is an example for how co-evolution operates. If the female bee's colour patterns change even slightly for any reason during evolution, pollination success will be reduced unless the orchid flower co-evolves to maintain the resemblance of its petal to the female bee.

9. Draw and explain a logistic curve for a population of density (N) at time (t) whose' intrinsic rate of natural increase is (r) and carrying capacity is (k).

A population growing in a habitat with limited resources show initially a lag phase , this is followed by phases of acceleration and deceleration , and finally an asymptote when the population density reaches carrying capacity (K) , A plot of N in relation to time (t) result in a sigmoid curve (Verhulst - Pearl Logistic Growth)

$$\frac{dN}{dt} = rN\left(\frac{K-N}{K}\right) = 1$$
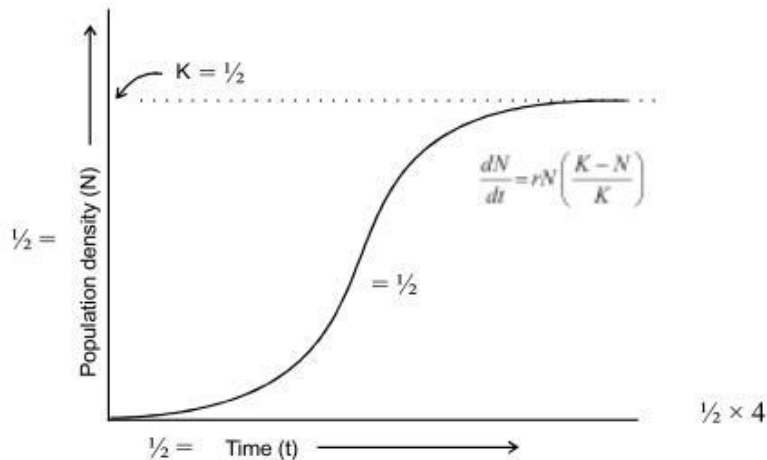
$$\frac{dN}{dt} = rN\left(\frac{K-N}{K}\right)$$

[2 + 1 + 2 = 5 marks]

Verhulst-Pearl Logistic Growth is described by the following equations
dN/dt = rN (K–N / N)
Where N = Population density at time t
r = Intrinsic rate of natural increase
K = Carrying capacity
Logistic Growth (Sigmoid curve is obtained)
When resources are limiting the Growth.
Resources for growth for most animal populations are finite and become limiting.
The logistic growth model is a more realistic one.

10. Differentiate between the following inter-specific interactions in a population:
(i) Mutualism and Competition
(ii) Commensalism and Amensalism

(b) (i) In mutualism both the species benefit = 1

In competition - survival of both challenged / struggle for existence = 1

(ii) Commensalism – One is benefitted. The other is neither benefitted nor harmed =1

Amensalism – One is harmed and the other is unaffected = 1

1) Study the graphical representation shown below and mention the conditions responsible for the curves "a" and "b" respectively. 2
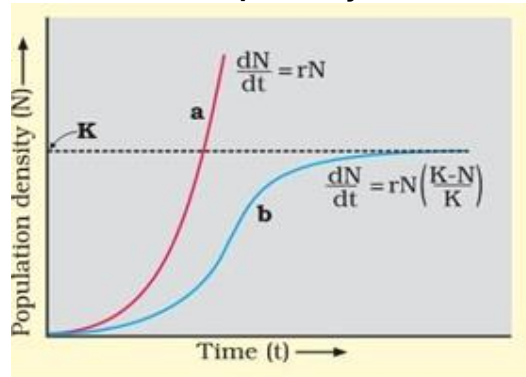
1) Curve 'a' represents exponential growth where the resources are not limiting the growth. 1

b) Curve 'b' represents logistic growth where the resources are limiting the growth 1

2)

a) Which type of growth curve does it represent?

2) a) Logistic growth curve ½

b) What do the notations represent in the above equation?

b) N= population density at-time't'1½

r=Intrinsic rate of increase

K= carrying capacity

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

Gause's 'Competitive Exclusion Principle' states that two closely related species competing for the same resources cannot co-exist indefinitely and the competitively inferior one will be eliminated eventually. This may be true if resources are limiting, but not otherwise.

More recent studies do not support such gross generalizations about competition. While they do not rule out the occurrence of inter-specific competition in nature, they point out that species facing competition might evolve mechanisms that promote co-existence rather than exclusion. One such mechanism is 'resource partitioning'.

If two species compete for the same resource, they could avoid competition by choosing, for instance, different times for feeding or different foraging patterns.

MacArthur showed that five closely related species of warblers living on the same tree were able to avoid competition and co-exist due to behavioral differences in their foraging activities

20. What is altitude sickness? What its causes and symptoms? How does human body try to overcome altitude sickness?

Breathlessness at high attitudes:

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 rate.

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

Ophrys employs 'Sexual deceit'

1.one petal bears uncanny resemblance to female of the bee.

2.Male bee is attracted to what it perceives as a female 'pseudocopulates,' during which pollen dusted on male bee¡¦s body.

3. Male bee transfers pollen to another flower when the same bee pseudocopulates with another flower.

4.Ophrys does so because pollination success will be reduced unlessit co-evolves with female bee.

21. Study the 3 representative figures of age pyramid relating to human population given below and **answer the following question:**

Figure 13.4 Representation of age pyramids for human population
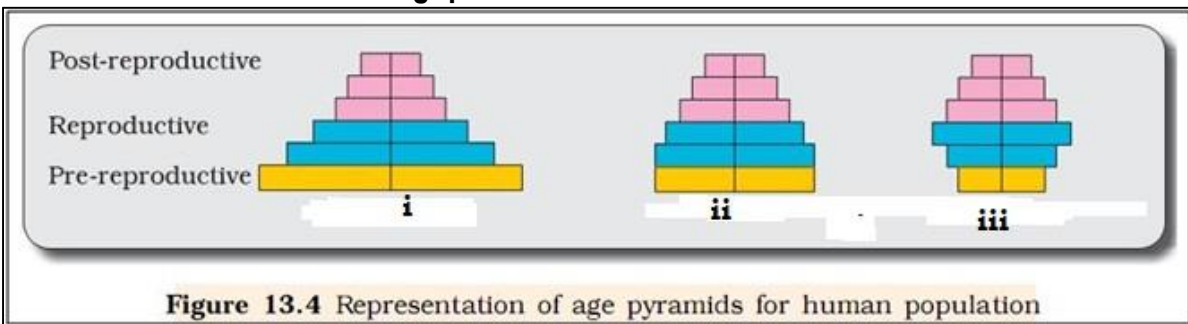
(a) Mention the names given to the 3 kinds of age profiles (i), (ii), and (iii).

(b) Which one of them is ideal for a population and why?

a)Expanding, Stable and Declining.

b) Stable (ii) is ideal for a population. Because such growth helps in maintenance of resources.

22. Answer the following questions:

(a) Write an equation for Verhulst Pearl logistic Growth Where

N = Population density at a time t

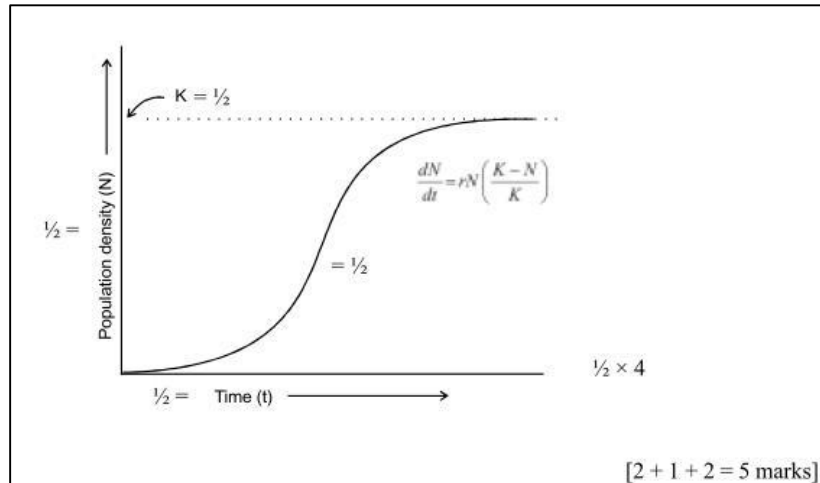r = Intrinsic rate of natural increase

and

K = Carrying Capacity 1

(b) Draw a graph for a population whose population density has reached the carrying capacity.

(c) Why is this logistic growth model considered a more realistic one for most animal populations? 1

Ans:

a) dN/dt = rN (K–N / N)

b)

$$\frac{dN}{dt} = rN\left(\frac{K-N}{K}\right)$$

[2 + 1 + 2 = 5 marks]

c) Since resources for growth for most animal populations are finite and become limiting sooner or later, the logistic growth model is considered a more realistic one.

26. Name the type of interactions seen in each of the following examples:
(a) *Ascaris* worms living in the intestine of Human
Ans:Parasitism
(b) Wasp pollinating fig inflorescence :
Ans:Mutualsim
(c) Clown fish living among the tentacles of Sea –anemone
Ans:Commensalism
(d) Mycorrhizae living on the roots of higher plants
Mutualsim
(e) Orchid growing on the branch of a Mango tree.
Ans:Commensalism
(f) Disappearance of smaller barnacles when Balanus dominated in the coast of Scotland.
Ans: Competitive release

27. Name the interaction in each of the following:
a) Cuscuta growing on a shoe flower plant.
b) Mycorrhizaa living on the roots of higher plants.
c) Clown fish living among the tentacles of sea anemone.
d) Koel laying her eggs in crow's nest.
e) Five closely related species of warblers living on the same tree
a. Parasitism
b. Mutualism
c. Commensalism
d. Brood parasitism
e).Competition with resource partitioning.