Very Short Answer Questions (PYQ)

[1 Mark]

Q. 1. Write the basis on which an organism occupies a space in its community/natural surroundings.

Ans. Feeding relationships with other organisms.

Q. 2. Name a 'photoperiod' dependent process, one each in plants and in animals.

Ans. In plants, flowering and in animals, migration/foraging are photoperiod dependent processes.

Q. 3. Between amphibians and birds, which will be able to cope with global warming? Give reasons.

Ans. Birds being eurythermals can tolerate a wide range of temperature and thus will be able to cope with global warming more efficiently.

Q. 4. Why are green algae not likely to be found in the deepest strata of the ocean?

Ans. The wavelength of light at the deepest strata is unsuitable for growth of green algae.

Q. 5. Why are some organisms called as eurythermals and some others as stenohaline?

Eurythermals are organisms that can tolerate and thrive in a wide range of temperature, whereas stenohalines can tolerate a narrow range of salinities.

Q. 6. Which one of the two, stenothermals or eurythermals, shows wide range of distribution on earth and why?

Ans. Eurythermals show a wide range of distribution on earth, as they show tolerance for wide range of temperatures.

Q. 7. Mention the effect of global warming on the geographical distribution of stenothermals like amphibians.

Ans. Due to global warming, stenothermals would either migrate or die due to change in the temperature.

Q. 8. Why do predators avoid eating Monarch butterfly? How does the butterfly develop this protective feature?

Ans. The Monarch butterfly is highly distasteful to its predator (birds) because of a special chemical present in its body. It acquires this chemical during its caterpillar stage by feeding on a poisonous weed.

Q. 9. State Gause's Competitive Exclusion principle.

Ans. Gause's Competitive Exclusion Principle states that two closely related species competing for same resources, cannot coexist indefinitely (the inferior will be eliminated).

Q. 10. What does nature's carrying capacity for a species indicate?

Ans. In nature, a given habitat has enough or limited resources to support a maximum possible number and nature's carrying capacity indicates that no further growth in population is possible.

Q. 11. If 8 individuals in a laboratory population of 80 fruit flies died in a week, then what would be the death rate of population for the said period?

Ans.

$$\text{Death rate} = \frac{\text{Number of individuals dead}}{\text{Total number of individual}} = \frac{8}{80} = 0.1$$

The death rate will be 0.1 individuals per week.

Q. 12. In a pond there were 20 Hydrilla plants. Through reproduction 10 new Hydrilla plants were added in a year. Calculate the birth rate of the population.

Ans.

$$\text{Birth rate} = \frac{\text{Number of individuals born}}{\text{Total number of individuals}} = \frac{10}{20} = 0.5$$

Birth rate is 0.5 plants per year.

Q. 13. In a pond there were 200 frogs. 40 more were born in a year. Calculate the birth rate of the population.

Ans. Birth rate = 0.2 frogs per year.

Q. 14. Pollinating species of wasps show mutualism with specific fig plants. Mention the benefits the female wasps derive from the fig trees from such an interaction.

Ans. The wasp uses the fruit as oviposition and the developing seeds for nourishing its larvae.

Q. 15. Why are cattle and goats not seen browsing on Calotropis growing in the fields?

Ans. Calotropis produces highly poisonous cardiac glycosides. Therefore, cattle and goats do not browse on them.

Q. 16. Give an example of an organism that enters 'diapause' and why.

Ans. Many species of Zooplankton under unfavourable conditions enters diapause which delay overall development.

Q. 17. Name the type of association that the genus Glomus exhibits with higher plants.

Ans. Symbiosis/Mycorrhizae/Mutualism.

Q. 18. When and why do some animals go into hibernation?

Ans. When the animals are not able to tolerate the stressful conditions like low temperature, they hibernate to avoid the stress by escaping in time since they can not migrate.

Q. 19. When and why do some animals like snails go into aestivation?

Ans. Snails undergo aestivation if they are unable to migrate in order to avoid stressful condition of high temperature.

Q. 20. Name the interaction between a whale and the barnacles growing on its back.

Ans. Commensalism

Q. 21. Name the interaction between sea anemone and the hermit crab that grows on it.

Ans. Commensalism

Q. 22. What is the interaction called between Cuscuta and shoe flower bush?

Ans. Parasitism

23. What is an interaction called when an orchid grows on a mango plant?

Ans. Commensalism.

Q. 24. What do phytophagous insects feed on?

Ans. Phytophagous insects feed on plant sap and other parts of plant.

Very Short Answer Questions (OIQ)

[1 Mark]

Q. 1. What is habitat?

Ans. The place where an organism lives and reproduces is called its habitat.

Q. 2. What causes the annual variations in the distinct seasons?

Ans. Cause of annual variations in the distinct seasons:

i. Tilt of the earth on its axis.
ii. Rotation of earth around the sun.

Q. 3. What do you mean by the term eurythermal?

Ans. The organism which can tolerate and thrive in a wide range of temperatures is called eurythermal.

Q. 4. What are stenothermals?

Ans. The organisms which are restricted to a narrow range of temperature are called stenothermals.

Q. 5. Expand CAM.

Ans. Crassulacean Acid Metabolism.

Q. 6. What is mycorrhiza?

Ans. Mycorrhiza is a symbiotic association between a fungus and the roots of higher plants.

Q. 7. Mention the organism that form lichen.

Ans. Algae (blue-green algae) and fungi together form lichen.

Q. 8. Give one function of aerenchyma in aquatic plants.

Ans. Aerenchyma gives buoyancy to the aquatic plants due to presence of air chambers.

Q. 9. Why are mammals the most successful animals on earth?

Ans. The mammals are most successful animals on earth because they can maintain a constant body temperature with high range of tolerance whether in Antarctica or in Sahara desert.

Q. 10. Why do people living in high altitude have more haemoglobin/high RBC count?

Ans. To acclimatise in high altitude, the people have more haemoglobin/high RBC count to compensate for the low oxygen availability.

Q.11. What would be the growth rate pattern when the resources are unlimited?

Ans. Exponential.

Q.12. What is a tree line?

Ans. When we go up the altitude, beyond a particular height no tree are found and the vegetation comprise only of shrubs and herbs. The altitude beyond which no tree is seen is known as tree line.

Q.13. Why has life history of variation evolved?

Ans. In order to maximise reproductive fitness of individual, life history of variation has evolved.

Q.14. What does ecological niche of an organism represent?

Ans. Ecological niche of an organism refers to the ranges of tolerance, the resources it utilises and its functional role in an ecosystem.

Q.15. What is meant by carrying capacity of the environment?

Ans. Carrying capacity is defined as the maximum number of individuals of a population that can be sustained by a given habitat or ecosystem.

Q.16. What are ectotherms?

Ans. Ectotherms are those animals whose body temperature changes and matches with that of the environment in which they are living. They are also called cold-blooded animals.

Q.17. What is meant by 'competitive release'?

Ans. Competitive release is a phenomenon in which a species whose distribution is restricted to a small geographical area because of the presence of a competitively superior species, is found to expand drastically when the competing species is removed.

Q.18. Name two organisms (one plant and one animal) which breed only once in their life time.

Ans. Pacific salmon fish and bamboo.

Q.19. What is Allen's rule?

Ans. According to Allen's rule, mammals in colder climate have shorter ears and shorter limbs to minimise heat loss.

Q.20. Name two processes which influence population density.

Ans. Immigration and natality influence population density.

Q.21. Species that tolerate wide range of salinity are called _____.

Ans. Euryhaline

Q.22. What does J-shaped growth curve of a population indicate?

Ans. The J-shaped growth curve indicates the minimum or absence of environmental resistance.

Q.23. What does sigmoid growth curve of a population indicate?

Ans. Sigmoid growth curve of a population indicates following characteristics:

(i) Initially the growth is slow.

(ii) The growth becomes rapid and the curve becomes steady due to environmental resistance.

Q.24. Name the two intermediate hosts on which human liver fluke depend to complete its life cycle.

Ans. Snail and fish.

Q.25. What are the two primary requirements of a parasite from the host?

Ans. The two primary requirements of a parasite from the host are:

(i) Shelter

(ii) Nutrition

Q.26. What is amensalism?

Ans. The mode of interaction between two species where one is harmed and the other is unaffected is called amensalism.

Short Answer Questions-I (PYQ)

[2 Marks]

Q.1. Explain the response of all communities to environment over time.

Ans. Environmental factors like temperature, water, light, soil, etc., may influence the members of communities in varying degrees. Organisms in response to these factors try to adapt according to their capacities, by maintaining a constant internal environment through homeostasis or migration to a less stressful environment or suspending activities till favourable conditions return.

Q.2. An organic farmer relies on natural predation for controlling plant pests and diseases. Justify giving reasons why this is considered to be a holistic approach.

Ans. Besides acting as 'conduits' for energy transfer across trophic levels, predators are used in biological control of plant pests. This ability of the predator is based on its regulating the prey population. The natural predators reduce interspecific competition and do not harm the crop plants. For example, in an area the invasive cactus can be brought under control by cactus-feeding predator (a moth). Using natural predation, the ecosystem is kept stable without harming any of the trophic levels.

Q.3. Apart from being part of the food chain, predators play other important roles. Mention any two such roles supported by examples.

Ans.

i. Keeps prey population under control. For example, the invasive prickly. Poor cactus in Australia was brought under control only after a cactus feeding predator (a moth) was introduced in the country.
ii. Maintains species diversity by reducing intensity of competition among prey species. For example, when the starfish *Pisaster* was removed from its community of American Pacific Coast, more than 10 species of invertebrates become extinct.

Q.4. Mention four adaptive features that help cacti survive in xeric environment.

Ans. Adaptation in desert plants:

i. Desert plants have thick waxy coating on leaf called cuticle for minimum loss of water, through transpiration.
ii. They have special photosynthetic pathway (CAM) that enables minimum loss of water during day time because stomata remain closed.
iii. Some desert plants develop spines instead of leaf and photosynthetic function is carried out by the flattened stem.
iv. Stomata are arranged in deep pits to minimise loss through transpiration.

Q.5. In certain seasons we sweat profusely while in some other season we shiver. Explain.

Ans. Human beings maintain a constant body temperature of 37°C.

- **In summers:** The outside temperature is much higher than our body temperature. Therefore, we sweat profusely. This results in evaporative cooling and our body temperature is brought down to normal (37°C).
- **In winters:** The outside temperature is much lower than our body temperature. Therefore, we start to shiver; this action (of shivering) is a kind of exercise (work) that produces heat and raises the body temperature.

Q.6. Why are small animals rarely found in the polar regions? Explain.

OR

Why are small birds like humming birds not found in polar regions? Explain.

Ans. Small animals like humming birds have a large surface area relative to their volume. So they tend to lose body heat very fast when it is cold outside. Then, these animals have to use their energy (generated by metabolic reactions) to generate body heat. That is the reason why small sized animals are rarely found in the polar regions.

Q.7. Why the plants that inhabit a desert are not found in a mangrove? Give reasons.

Ans. In mangroves the soil is oxygen deficit because of excess water present. Plants in mangroves develop special roots called breathing roots or pneumatophores for respiration. This adaptation is not present in desert plants because of which they do not survive in mangroves.

Q.8. Bear hibernates whereas some species of zooplanktons enter diapause to avoid stressful external conditions. How are these two ways different from each other?

Ans. Hibernation is the winter sleep seen in cold-blooded animals in polar regions in which they suspend their metabolic activities when external temperature becomes unfavourable. Whereas, diapause is the phenomenon seen in insects during their developmental stages, in which metabolic activities are suspended due to unfavourable conditions.

Q.9. Many fresh water animals cannot survive in marine environment. Explain.

Ans. Marine environment has high salt concentration. These fresh water animals in such hypertonic surroundings suffer from osmotic problems. Their bodies start losing water by exosmosis.

Q.10. How do seals adapt to their natural habitat? Explain.

Ans. Seals adapt to the cold climate by developing a thick layer of fat (blubber) below their skin that acts as an insulator and reduce excess loss of body heat.

Q.11. Some organisms suspend their metabolic activities to survive in unfavourable conditions. Explain with the help of any four examples.

Ans.

i. Polar bear—They hibernate during winter to escape the cold weather.
ii. Snails/fishes—They go into aestivation during summer to avoid heat related problems and desiccation.
iii. Seeds of higher plants/spores of bacteria/fungi—They become dormant in unfavourable conditions and in case of *Amoeba* cyst formation takes place.
iv. Some species of zooplankton—They undergo diapause.

Q.12. Plants that inhabit a rain-forest are not found in a wetland. Explain.

Ans. Plants in wetland are adapted differently. The soil in wetland lacks oxygen. So, for respiration the roots have to grow above the soil. These roots are called breathing roots or pneumatophores. This feature is not present in roots growing in rainforest.

Q.13. How does our body adapt to low oxygen availability at high altitudes?

Ans. Our body adapts to low oxygen availability by increasing red blood cell production, decreasing the binding capacity of haemoglobin and by increasing breathing rate.

Q.14. How does a desert plant adapt to the dry, warmer environmental conditions?

Ans. Adaptations of a desert plant:

i. Leaf surface has a thick cuticle.
ii. Stomata are situated in deep pits.
iii. Stem is flattened and performs photosynthesis.
iv. Leaves are modified into spines as in *Opuntia*. (*Any two*)

Q.15.

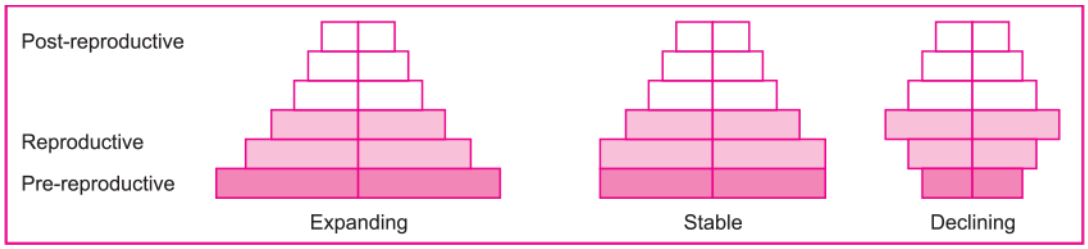
a. Explain “birth rate” in a population by taking a suitable example.
b. Write the other two characteristics which only a population shows but an individual cannot.

Ans.

a. Birth rate is expressed as the number of births per 1,000 individuals of a population per year. For example, in a pond there were 200 frogs and 40 more were born in a year. Then, the birth rate of the population will be 40/200 = 0.5 frogs per year.
b. Sex ratio, age distribution, population density, population growth. (*Any two*)

Q.16. Construct an age pyramid which reflects an expanding growth status of human population.

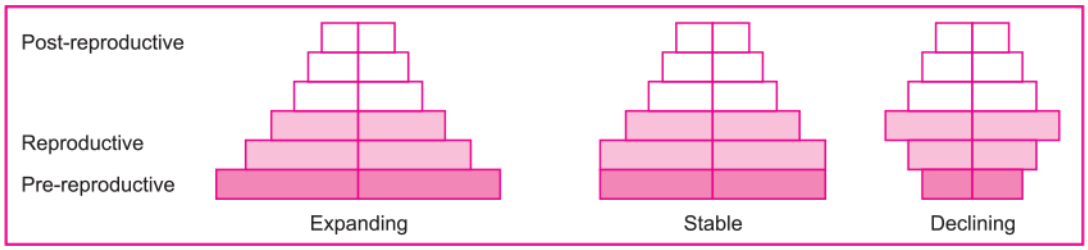
Ans.



Representation of age pyramids for human population

Q.17. Construct an age pyramid which reflects a stable growth status of human population.

Ans.



Representation of age pyramids for human population

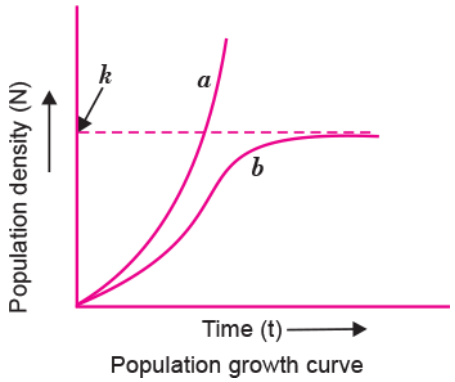
Q.18.

a. What is "r" in the population equation given: dN/dt = rN?
b. How does the increase and the decrease in the value of 'r' affect the population size?

Ans.

a. 'r' is called intrinsic rate of natural increase.
b. Population size increases with increase in 'r' and it decreases with decrease in 'r'

Q.19. Identify the curves '*a*' and '*b*' shown in the graph given below. List the conditions responsible for growth patterns '*a*' and '*b*'.



Population growth curve

Ans. Curve '*a*' is exponential growth curve. When the resources (food + space) are not limited, this type of growth curve appears.
Curve '*b*' is logistic growth curve. When the resources become limited at certain point of time, this type of growth curve appears.

Q.20. Explain Verhulst-Pearl Logistic Growth of a population.

Ans. According to Verhulst–Pearl Logistic growth, a population growing in a habitat with limited resources initially shows a lag phase, followed by phases of acceleration and deceleration and finally an asymptote when the population density reaches the carrying capacity. It is given by the following equation:

$$\frac{dN}{dt} = rN\left[\frac{K-N}{K}\right]$$

where N = population density at time t
r = intrinsic rate of natural increase
K = carrying capacity.

Q.21. Co-evolution is a spectacular example of mutualism between an animal and a plant. Describe co-evolution with the help of an example.

OR

Describe the mutual relationship between fig tree and wasp and comment on the phenomenon that operates in their relationship.

Ans. Co-evolution can be observed in Fig (plant) and wasp (animal). The female wasp uses the fruit for oviposition or egg laying. It also uses developing seeds within the fruit for nourishing its larvae. The wasp in turn pollinates the fig inflorescence. The given Fig species can be pollinated by its 'partner' wasp species and no other species.

Q.22. Egrets are often seen along with grazing cattle. How do you refer to this interaction? Give a reason for this association.

Ans. The interaction between them can be referred to as commensalism. Egrets always forage close to where the cattle are grazing because the cattle, as they move stir up

and flush out insects from the vegetation which otherwise might be difficult for the egrets to find and catch.

Q.23. Explain brood parasitism with the help of an example.

Ans. Koel is a parasitic bird (which has lost the instinct to make its own nest to lay eggs), has evolved the technique of laying eggs in the nest of a crow.
Its eggs bear resemblances to those of crow.

Q.24. Explain parasitism and co-evolution with the help of one example of each.

Ans. Mode of interaction between two species in which one species (parasite) depends on the other species (host) for food and shelter is called parasitism. In this one organism is benefitted and the other is harmed.

For example, Human liver fluke or Malarial parasite or *Cuscuta*.

Co-evolution is the relationship between two interacting organisms where both organisms failed to survive in the absence of the other.

For example, Fig and fig wasp or Ophrys and bumble bee.

Q.25. What is mutualism? Mention any two examples where the organisms involved are commercially exploited in agriculture.

Ans. Interaction between two species in which both are benefited is called mutualism.

i. Rhizobium in the roots (nodules) of legumes.
ii. Mycorrhiza Glomus with the roots of higher plants.

Q.26. How does the Mediterranean orchid Ophrys ensure its pollination by bees?

Ans. The petals of the Ophrys resembles the female of a bee species in size, colour and odour, etc. Male bee mistakes the Ophrys for female bee and tries to copulate. Few pollen grains adhered with the body of the male bee fall over stigma of the flower thereby leading to pollination.

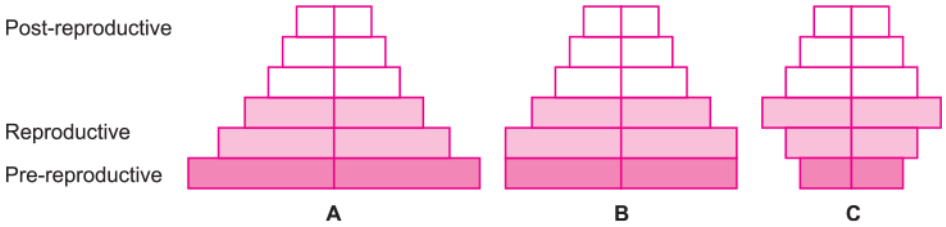
Q.27. How do plants benefit from having mycorrhizal symbiotic association?

Ans. Mycorrhizal association is found between fungi and the roots of higher plants. The fungi help the plant in the absorption of essential nutrients from the soil while plant in turn provides energy-yielding carbohydrates to fungi.

Q.28. Why do clown fish and sea anemone pair up? What is this relationship called?

Ans. The clown fish gets protection from predators which stay away from stinging tentacles of anemone but anemone does not derive any benefit from the fish. This relationship is called commensalism.

Q.29. Study the three different age pyramids for human population given below and answer the questions that follow:



a. Write the names given to each of these age pyramids.
b. Mention the one which is ideal for human population and why.

Ans.

a. A — Expanding pyramid B — Stable pyramid C — Declining pyramid
b. Stable pyramid is ideal for human population because it maintains the stability in all population phases.

Q.30. Answer the following questions:

Q. How is *Cuscuta* adapted to be a parasitic plant?

Ans. *Cuscuta* has lost its chlorophyll and leaves during evolution and thus it derives its nutrition from host plant, thus, it is a parasitic plant.

Q. Why do cattle avoid browsing on Calotropis plants? Explain.

Ans. Cattle avoid browsing on *Calotropis* plants because it produces poisonous cardiac glycosides.

Short Answer Questions-I (OIQ)

[2 Mark]

Q.1. Explain relationship between biotic potential and environmental resistance.

Ans. Biotic potential is defined as the maximum inherent capacity of an organism to reproduce or increase the number of individuals. Whereas the environmental resistance is the biotic and abiotic factors of the environment, that do not allow the population of organisms to grow unlimited and keep the population size in control.

Q.2. "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 state the possible reasons for the same.

Ans. 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.

Q.3. Why are coral reefs not found from West Bengal to Andhra Pradesh but found in Tamil Nadu on the east coast of India?

Ans. High salinity, optimal temperature and less siltation are essential to colonise corals. If siltation and fresh water inflow are very high, the corals don't colonise. In contrast when the siltation and fresh water in flow by the rivers are very less, the corals do colonise.

Q.4. Besides acting as 'conduits' for energy transfer across trophic levels, predators play other important roles. Justify.

Ans. Besides acting as 'conduits' of energy transfer across trophic levels, predators play other important roles like

i. They keep prey population under control.
ii. Predators also help in maintaining species diversity in a community by reducing the intensity of competition among competing prey species.

Q.5. Is it possible to achieve 'zero population growth rate'? If yes, what kind of age pyramid is obtained?

Ans. Yes. An inverted bell shaped age pyramid is obtained. The young or pre-reproductive age group individuals are less in number and both post-reproductive and reproductive stage are in the same level.

Q.6. Name the type of curve that characterises most population growing in favourable environment. Also define carrying capacity.

Ans. When the environment is favourable, the growth curve is J-shaped.

In nature, a given habitat has resources to support only a certain number of individuals of a population beyond which no further growth is possible. This limit is called carrying capacity (K).

Q.7.

a. Label the three tiers 1, 2, 3 given in the above age pyramid.
b. What type of population growth is represented by the above age pyramid?

Ans.

a.
    1. represents Pre-reproductive age group
    2. represents Reproductive age group
    3. represents Post-reproductive age group
b. Expanding population.

Q.8. Name two basic types of competition found amongst organisms. Which one of them is more intense and why?

Ans. The two basic types of competitions are:

i. Interspecific competition
ii. Intraspecific competition

The intraspecific competition is more intense because the requirement of the individual of the species are similar.

Q.9. What is Gause's competitive exclusion principle? Explain with an example.

Ans. Gause's competitive exclusion principle states that two closely related species competing for the same resource cannot coexist indefinitely and the competitively inferior one will be eliminated eventually by the superior one. For example, after the introduction of goats in Galapagos Islands, the Abingdon tortoise became extinct within a decade due to greater browsing efficiency of the goats.

Q.10. Name the interaction in each of the following:

Q. *Cuscuta* growing on a shoe flower plant.

Ans. Parasitism

Q. Mycorrhizae living on the roots of higher plants.

Ans. Mutualism

Q.11. The 'clown' fish lives among the tentacles of sea anemone. What is this interaction between them called and why?

Ans. The interaction between clown fish and sea anemone is called commensalism. The clown fish gets protection from predators which stay away from the stinging tentacles of sea anemone. The sea anemone does not appear to derive any benefit by hosting the clown fish.

Q.12. In a sea shore, the benthic animals live in sandy, muddy and rocky substrata and accordingly developed the following adaptations. Find the suitable substratum against each adaptation.

a. Burrowing _____
b. Building cubes _____
c. Holdfasts/peduncle _____

Ans.

a. Sandy,
b. Muddy,
c. Rocky.

Q.13. Categorise the following plants into hydrophytes, xerophytes, halophytes and mesophytes. Write the type of plant against the following examples.

a. Salvinia
b. Opuntia
c. Rhizophora
d. Mangifera

Ans.

a. Hydrophyte
b. Xerophyte
c. Halophyte
d. Mesophyte

Q.14. In a pond, we see plants which are free-floating, rooted-submerged, rooted emergent, rooted with floating leaves. Write the type of plants against each of them.

a. *Hydrilla,*
b. *Typha,*
c. *Nymphaea,*
d. *Lemna,*
e. *Vallisnaria*

Ans.

a. Submerged
b. Rooted emergent
c. Rooted with floating leave
d. free-floating
e. Rooted Submerged

Q.15. The density of a population in a habitat per unit area is measured in different units. Write the unit of measurement against the following:

a. **Bacteria**
b. **Grass**
c. **Banyan**
d. **Deer**
e. **Fish**

Ans.

a. Numbers/volume
b. Coverage/area
c. Biomass/area
d. Numbers/area
e. Weight/area

Short Answer Questions-II (PYQ)

[3 Marks]

Q.1.

a. Write the importance of measuring the size of a population in a habitat or an ecosystem.
b. Explain with the help of an example how the percentage cover is a more meaningful measure of population size than mere numbers.

Ans.

a. By measuring the size of a population, following can be predicted:
   i. Status of the population in a habitat.
   ii. Outcome of competition with other species.
   iii. Impact of predator or pesticides.
   iv. Increase or decrease of population size.

[*Any two*]

b. **Example:** Banyan tree and *Parthenium* plants.
When 1 banyan tree is compared with 100 *Parthenium* plants, the population of banyan in terms of number is very much low as compared to *Parthenium*. But in terms of percentage cover or biomass, the banyan provides a much larger cover in comparison to 100 *Parthenium* plants. Thus, the percentage cover or biomass is a more meaningful measure of population size.

Q.2. How do organisms which cannot migrate, tend to overcome adverse environmental conditions? Explain taking one example each from vertebrates and angiosperms respectively.

Ans. Organisms which cannot migrate tend to overcome adverse environmental conditions by developing several methods/features. For example, some vertebrates escape the stress caused by unfavourable environmental conditions by escaping in time like bears go into hibernation during the winter months. In angiosperms, seeds and some other vegetative reproductive structures serve as means to tide over periods of stress. They reduce their metabolic activity and go into an inactive, *i.e.*, 'dormant' state. They germinate to form new plant when the favourable conditions return.

Q.3. How do organisms manage with stressful conditions existing in their habitat for short duration? Explain with the help of one example each.

OR

Explain with the help of suitable examples the three different ways by which organisms overcome their stressful conditions lasting for short duration.

Ans. If the stressful conditions remain for short duration, the organism has following alternatives, *i.e.*, either conform, migration, suspension.

i. **Conform:** In some animals called conformers, osmotic concentration of body fluids change with that of the ambient water osmotic concentration. For example, small animals have larger surface area relative to their volume. They lose body heat very fast in low temperature. So, they expand energy to generate body heat through metabolism.
ii. **Migration:** The temporary movement of organism from the stressful habitat to a more hospitable area and return when stressful period is over is called migration. For example, migratory birds from Siberia come to Keoladeo National Park (Bharatpur) in every winter.
iii. **Suspend:** Those animals who fail to migrate, might avoid the stress by escaping in time. Hibernation of bears during winter or aestivation of snails and fish to avoid in summer are examples of this phenomenon.

Q.4. How do organisms like fungi, zooplanktons and bears overcome the temporary short-lived climatic stressful conditions? Explain.

Ans. Fungi form thick-walled spores which help them survive in unfavourable conditions. On availability of suitable environment, these germinate.

Zooplanktons in lakes and ponds under unfavourable conditions, enter diapause, a stage of suspended development.

Bears in extreme low temperatures, escape winter time by hibernating.

Q.5. How do organisms cope with stressful external environmental conditions which are localised or of short duration?

Ans. The following methods are employed by organisms to cope with stressful conditions:

i. Migrate temporarily from the stressful habitat to a hospitable area,
ii. suspend activities, 3
iii. form thick walled spores,
iv. form dormant seeds,
v. hibernate during winter,
vi. aestivate during summer,
vii. planktons undergo diapause.

Q.6.

a. State how the constant internal/environment is beneficial to organisms.
b. Explain any two alternatives by which organisms can overcome stressful external conditions.

Ans.

a. Constant internal environment permits all biochemical reaction and physiological functions to proceed with maximal efficiency and thus enhance the overall fitness of the species.
b. Organisms can overcome stressful external conditions with the following ways:
    i. Regulation: Maintaining internal environment by maintaining constant body temperature or osmotic concentration.
    ii. Suspend (conform): By suspending metabolic activities through hibernation or aestivation diapause.
    iii. Migration: Organisms migrate temporarily to more hospitable areas.

Q.7. Different animals respond to changes in their surroundings in different ways. Taking one example each, explain "some animals undergo aestivation while some others hibernation". How do fungi respond to adverse climatic conditions?

Ans. Some animals go into aestivation to avoid summer problems like, heat and dessication. For example, snails and fish.

Some animals go into hibernation to avoid winter related problem like, extreme cold. For example, bear.

Fungi form thick walled spores and suspend their activities to respond to adverse climatic conditions.

Q.8. Water is very essential for life. Write any three features both for plants and animals which enable them to survive in water scarce environment.

Ans.

Plants: Ephemeral mode (complete life cycle in short period); deep tap roots; deciduous leaves; waxy cuticle; sunken stomata; succulence to store water; C_4 or CAM pathway of photosynthesis. (*Any three*)

Animals: No sweating; uricotelic; deposition of fat in sub-epidermal layer; burrowing nature; thick skin; body covered with scales. (*Any three*)

Q.9. How do kangaroo, rats and desert plants adapt themselves to survive in their extreme habitat? Explain.

Ans. Kangaroo rats are capable of meeting its water requirements through its internal fat oxidation in which water is a by product. It also has the ability to concentrate its urine so that minimal volume of water is used to remove excretory products.

Desert plants have a thick cuticle on their leaf surface and have their stomata arranged in deep pits to minimise water loss. They also have leaves reduced to spines and deep roots to tap water. They have a special photosynthetic pathway (CAM).

Q.10.

a. **List any three ways of measuring population density of a habitat.**
b. **Mention the essential information that can be obtained by studying the population density of an organism.**

Ans.

a. By physical counting, percent cover or total biomass, from relative density, counting pug marks, counting faecal pellets. (*Any three*)
b. Status of habitat, whether competition for survival exists or not, whether population is increasing or declining, natality, mortality, emigration, immigration.

Q.11.

a. **"Organisms may be conformers or regulators." Explain this statement and give one example of each.**
b. **Why are there more conformers than regulators in the animal world?**

Ans.

a. Conformers are organisms which cannot maintain a constant internal environment under varying external environmental conditions. They change body temperature and osmotic concentration with change in external environment. For example, all plants, fishes, amphibians etc.
   Regulators are organisms which can maintain homoeostasis (by physiological means or behavioural means) *i.e.*, they maintain constant body temperature and osmotic concentration. For example, birds and mammals.
b. Thermoregulation is energetically expensive for animals. Therefore, more conformers are found.

Q.12. Explain mutualism with the help of any two examples. How is it different from commensalism?

Ans. Mutualism

- Mutualism is referred to as the interspecific interaction in which both the interacting species are benefited.
- Some examples of mutualism

a. Lichens represent close association between fungus and photosynthetic algae or cyanobacteria, where the fungus helps in the absorption of nutrients and provides protection while algae or cyanobacterium prepares the food.
b. Mycorrhizae are close mutual association between fungi and the roots of higher plants, where fungi helps the plant for absorption of nutrients while the plant provides food for the fungus.

In commensalism, one species benefits and the other is neither benefitted nor harmed whereas in mutualism both the species are benefitted.

Q.13. When do you describe the relationship between two organisms as mutualistic, competitive and parasitic? Given one example of each type.

Ans. Mutualism is referred to as the interspecific interaction in which both the interacting species are benefited from each other. For example, lichens represent close association between fungus and photosynthetic bacteria.

Competition is a type of interaction due to limited resources between closely related species where they compete for the same resource and both species suffer. For example, In South American lakes, visiting flamingos and resident fishes compete for zooplanktons.

Parasitism is the mode of interaction between two species in which one species (parasite) depends on the other species (host) for food and shelter, and in the process damages the host. For example, human liver fluke depends on two hosts, a snail and a fish, to complete its life cycle.

Q.14. Name the type of interaction seen in each of the following examples:

Q. *Ascaris* worms living in the intestine of humans

Ans. Parasitism

Q. Wasp pollinating fig inflorescence

Ans. Mutualism

Q. Clown fish living among the tentacles of sea-anemone

Ans. Commensalism

Q. Mycorrhizae living on the roots of higher plants

Ans. Mutualism

Q. Orchid growing on a branch of a mango tree

Ans. Commensalism

Q.15. Predation is usually referred to as a detrimental association. State any three positive roles that a predator plays in an ecosystem.

OR

Mention any two significant roles predation plays in nature.

Ans.

i. They predators act as conduits for energy transfer across trophic levels.
ii. They keep prey populations under control.
iii. They help in maintaining species diversity in a community by reducing the intensity of competition among prey species.

Q.16. Explain co-evolution with reference to parasites and their hosts. Mention any four special adaptive features evolved in parasites for their parasitic mode of life.

Ans. If the host evolves special mechanism for rejecting or resisting the parasite, they both live in a relationship called co-evolution. The parasite has to (simultaneously) evolve/co-evolve the mechanism to counter act and neutralise them.

a. **Parasitic adaptation in Animals**
    i. The parasite have evolved to be host-specific in such a manner that both host and parasite tend to co-evolve.
    ii. Loss of unnecessary sense organs.
    iii. Presence of adhesive organs or suckers.
    iv. Loss of digestive system.
    v. High reproductive capacity.
b. **Parasitic adaptation in plants**
    i. Haustoria in *Cuscuta*
    ii. Loss of chlorophyll
    iii. Loss of leaves/foliage

Q.17. Differentiate between mutualism, parasitism and commensalism. Provide one example for each of them.

Ans.

i. **Parasitism**
- It is the mode of interaction between two species in which one species (parasite) depends on the other species (host) for food and shelter, and in this process damages the host. In this process one organism is benefited (parasite) while the other is being harmed (host).
- The life cycles of some parasites are complex where one or more intermediate host or vectors to facilitate parasitisation are present.
- The human liver fluke depends on two intermediate hosts, a snail and a fish, to complete its life cycle.

ii. **Commensalism**
- Commensalism is referred to as the interaction between two species where one species is benefited and the other is neither harmed nor benefited.
- **Example of commensalism:**
- An orchid growing as an epiphyte on a mango tree. The orchid gets shelter and nutrition from mango tree while the mango tree is neither benefited nor harmed.

iii. **Mutualism**

- Mutualism is referred to as the interspecific interaction in which both the interacting species are benefited.
- **Example of mutualism**
- Lichens represent close association between fungus and photosynthetic algae or cyanobacteria, where the fungus helps in the absorption of nutrients and provides protection while algae or cyanobacterium prepares the food.

Q.18. Differentiate between commensalism and mutualism by taking one example each from plants only.

Ans.

S. No.	Mutualism	Commensalism
(*i*)	It is an interspecific interaction in which both the species (individuals) are mutually benefited.	It is an interspecific interaction in which one species is benefited and other is neither harmed nor benefited.
(*ii*)	The two individuals may be physically or physiologically associated.	The two individuals may be physically associated.
(*iii*)	*E.g.*, Rhizobium and the legume plants.	*E.g.*, Sucker fish and shark.

Q.19. Differentiate between parasitism and competition, giving one example of each. State the common characteristic they share.

Ans.

	Parasitism	Competition
(i)	It is the interaction in which one species is benefited and the other is harmed.	It is the interaction in which both species are harmed.
(ii)	For example, tapeworm in humans, ticks on dogs.	For example, herbivores and plants in an area.

Common characteristic: Species facing competition might evolve mechanisms that promote co-existence. Similarly, in parasitism both host and parasite tend to co-evolve.

Q.20.

a. **Explain any two defence mechanisms plants evolved against their predators.**
b. **How does predation differ from parasitism?**

Ans.

a. Plants developed the following defence mechanisms:
    i. Thorns as means of defence.
    ii. Plants may produce chemicals such as nicotine, caffeine, quinine, strychnine, opium for defence.

b.

Parasitism	Predation
1. The parasite lives and feeds on the host. 2. The parasite is host specific. 3. The parasite coevolves with the host.	1. The predator only feeds on prey. 2. The predator is not prey specific. 3. The predator keeps a check on prey population.

Q.21. Highlight the differences and a similarity between the following population interactions: competition, predation and commensalism.

Ans. Differences:

Competition	Predation	Commensalism
1. In this type of interaction boththe species suffer.	1. In this type of interaction the predator kills and consumes the prey	1. In this type of interaction one species is benefited and the other is neither harmed nor benefited.
2. It occurs due to limited resources between closely related species.	2. It is the nature's way of transferring energy to higher trophic level.	2. It is not particularly for any gain of energy or resources.
3. For *e.g*., In American lakes visiting flamingos and resident fish.	3. For *e.g*., tiger (predator) and deer (prey).	3. For *e.g.*, sucker fish andshark.

Similarity: All these interactions leads to evolution as the fittest organism survives.

Q.22. Highlight the differences between the population interactions given below. Given an example of each.

a. Parasitism
b. Amensalism
c. Mutualism

Ans.

Parasitism	Amensalism	Mutualism

1. In this interaction one species (parasite) depends on the other species (host) for food and shelter.	1. In this interaction one species is harmed and the other is neither benefited nor harmed.	1. In this interaction both the interacting species are benefited.
2. The interacting species coevolve.	2. No evolution is observed.	2. The interacting species co-evolve.
3. For *e.g.*, Cuscuta is commonly found growing on hedge plants.	3. For *e.g.*, the mould *Penicillium* secretes penicillin which kills bacteria but the mould is unaffected.	3. For *e.g.*, Rhizobium and the legume plants.

Q.23. Answer the following questions:

Q. List the biotic components an organism interacts with in its natural habitat.

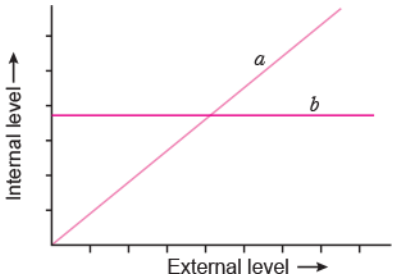
Ans. Plants, animals and microorganisms.

Q. Mention how have organisms optimised their survival and reproduction in a habitat.

Ans.

i. Some organisms regulate to maintain homeostasis by physiological and behavioural means.
ii. In some animals and plants the osmotic concentration of the body fluids change with that of the ambient water osmotic concentration (Conform).
iii. Some animals migrate to avoid unfavourable conditions.
iv. Some bacteria, fungi and lower plants, under unfavourable conditions slow down metabolic rate and form a thick-walled spore to overcome stressful conditions (Suspend).

Q.24. The following graph represents the organismic response to a certain environmental condition (*e.g.*, temperature):



i. Which one of these, '*a*' or '*b*', depicts conformers?
ii. What does the other line graph depict?
iii. How do these organisms differ from each other with reference to homeostasis?
iv. Mention the category to which humans belong.

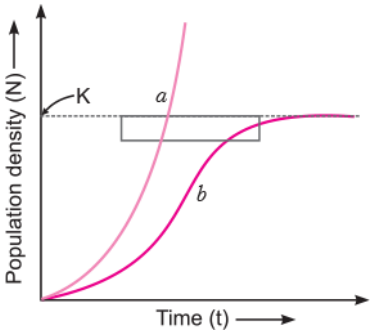
Ans.

i. ‘a’ depicts conformers.
ii. The other line depicts response of the regulators.
iii.

Conformers	Regulators
Aquatic animals and plants in which the osmotic concentration/body temperature of body fluids changes according to the ambient conditions/ environment of water/environment are called conformers.	Some organisms are able to maintain homeostasis by physiological means which ensures constant body temperature, constant osmotic concentration, etc.

iv. Regulators.

Q.25. Study the graph given below and answer the questions which follow:



(i) The curve ‘*b*’ is described by the following equation:

What does ‘K’ stand for in this equation? Mention its significance.

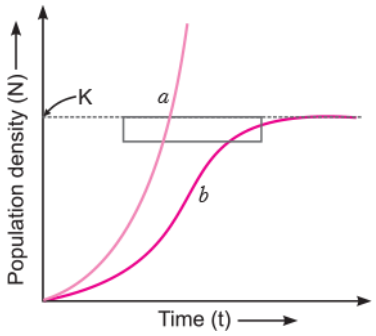
(ii) Which one of the two curves is considered a more realistic one for most of the animal populations?

(iii) Which curve would depict the population of a species of deer if there are no predators in the habitat? Why is it so?

Ans.

i. ‘K’ stands for carrying capacity. Carrying capacity is defined as the maximum number of individuals of a population that can be sustained by the given habitat/environment.
ii. Curve ‘*b*’ is more realistic.
iii. Curve ‘*a*’. When the predators are absent, the prey population grows exponentially.

Q.26. Study the population growth curves in the graph given below and answer the questions that follow:



(i) Identify the growth curves ‘a’ and ‘b’.

(ii) Which one of them is considered a more realistic one and why?

(iii) If $\frac{dN}{dt} = rN\left\{\frac{K-N}{K}\right\}$ is the equation of the logistic growth curve, what does K stand for?

(iv) What is symbolised by N?

Ans.

i. *a* is exponential growth curve or J-shaped curve.
b is logistic growth curve or S-shaped curve.
ii. Logistic growth curve (*b*) is considered more realistic because unlimited resources are never available in an ecosystem or in a habitat.
iii. K stands for carrying capacity.
iv. N indicates population density, which is the number of species of a population per unit area.

Long Answer Questions (PYQ)

[5 Marks]

Q.1. (a) List any three parameters used by ecologists under different situations to measure the population size in a habitat.

(b) Mention what do the following stand for in the equation given below:

i. **N_{t+1},**
ii. **B and**
iii. **E.**

$N_{t+1} = N_0 + [(B + I) – (D + E)]$

Given an explanation for the above equation.

Ans.

- The size of a population depends on food availability, predation pressure and weather. Therefore, size of the population is not a static parameter.
- The population density depends on few basic processes:

  i. **Natality:** It is the number of births during a given period of time. It increases the population density.
  ii. **Mortality:** It is the number of deaths in a given time period. It decreases the population density.
  iii. **Immigration:** It is the number of individuals of same species added to a habitat in a given time period. It increases the population density.
  iv. **Emigration:** It is the number of individuals of same species that move to a different habitat in a given time period. It decreases the population density.

- The population density is given by the following equation:

$$N_t = N_0 + [(B + I) - (D + E)]$$

where N_t = population density at time t, B = birth rate, I = immigration, D = death rate, E = emigration, and N_0 = population in the beginning.

- This equation shows that the population density will increase, if the number of births plus the number of immigrants (B+I) is more than the number of deaths plus the number of emigrants, *i.e*., (D+E), otherwise it will decrease.

Q.2. 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).

Ans. Logistic growth

- The resources become limited at certain point of time, so no population can grow exponentially.
- This growth model is more realistic.
- Every ecosystem or environment or habitat has limited resources to support a particular maximum number of individuals called its **carrying capacity (K)**.
- When N is plotted in relation to time t, the logistic growth show sigmoid curve and is also called **Verhulst–Pearl logistic growth**. It is given by the following equation:

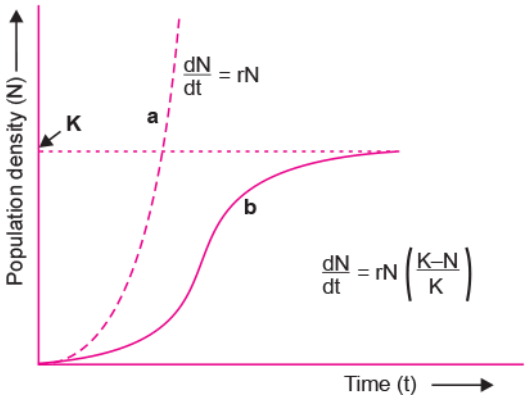
$$\frac{dN}{dt} = rN\left[\frac{K - N}{K}\right]$$

where

N = population density at time t

r = intrinsic rate of natural increase

K = carrying capacity.



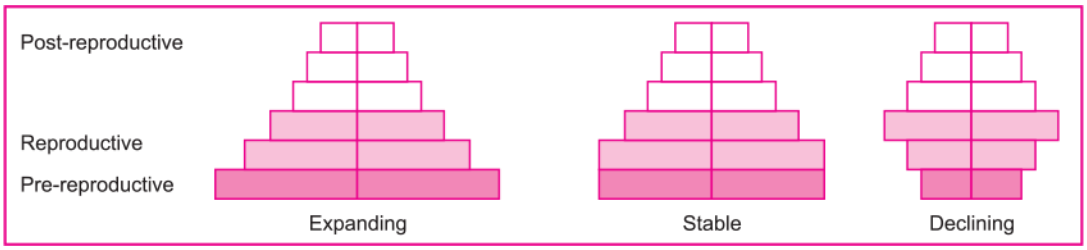
Population growth curve:
(a) When resources are not limiting the growth, plot is exponential. (b) When resources are limiting the growth, plot is logistic, K is carrying capacity.

Q.3. (a) Represent diagrammatically three kinds of age-pyramids for human populations.

(b) How does an age pyramid for human population at given point of time helps the policy-makers in planning for future.

Ans.

a.



Representation of age pyramids for human population

b. Age pyramid helps in planning the healthcare programmes, the education policies and the infrastructure of the area. Analysis is of age pyramid of a population can give the correct information about the status of the people in the area.

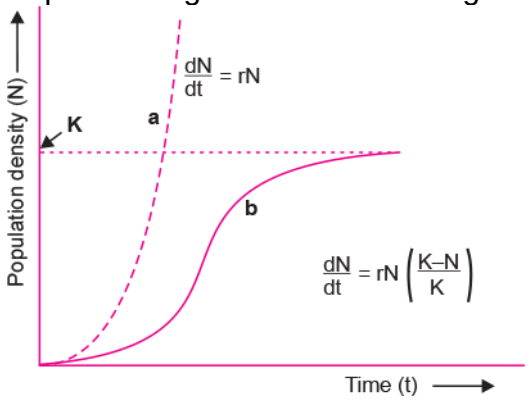
Q.4. (a) Name the two growth models that represent populations growth and draw the respective growth curves they represent.

(b) State the basis for the difference in the shape of these curves.

(c) Which one of the curves represent the human population growth at present? Do you think such a curve is sustainable? Give reason in support of your answer.

Ans.

a. Exponential growth curve and logistics growth curve



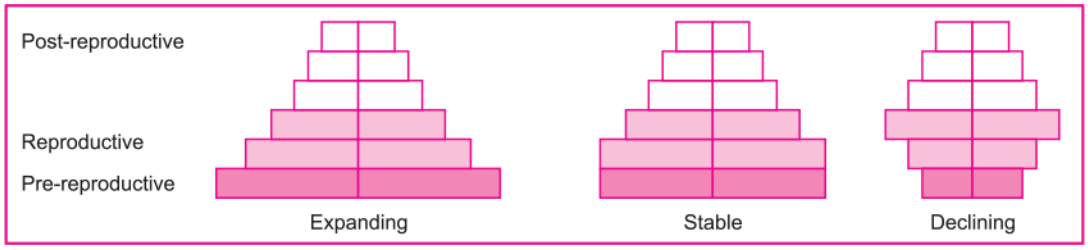
b. The difference in the shape of the curve is due to the amount of resources available for the given population. When resources are unlimited, each species realises its innate potential to grow in number and result in a J-shaped curve in exponential growth while in logistics growth no population has unlimited resources leading to competition or resources and show S-shaped curve.

c. Logistic growth represents human population growth at present. Such a curve is not sustainable because with growing population natural resources are getting depleted and its availability is not increasing enough.

Q.5. "Analysis of age-pyramids for human population can provide important inputs for long-term planning strategies." Explain.

Ans.

- A population at any given time is composed of individuals of different ages. When the age distribution (per cent individuals of a given age or age group) is plotted for the population, the resulting structure is called age pyramid.
- For human population, the age pyramids generally show age distribution of males and females in a combined diagram.
- The shape of the pyramids reflects the growth status of the population and is of three types:
    a. Expanding (Triangular shaped pyramid)
    b. Stable (Bell shaped pyramid)
    c. Declining (Urn shaped pyramid).
- The pyramids also indicate the ratio of pre-reproductive, reproductive and post-reproductive individuals in a population.



Representation of age pyramids for human population

Through analysis of the age pyramids of a population proper planing of health, education, transport, infra-structure, finance, food and employment can be done.

Thus, long-term management of resources can be done so that maximum benefits can be provided to the population.

Q.6. Answer the following questions:

Q. List the different attributes that a population has and not an individual organism.

Ans. Attributes of population : Birth rate, death rate, sex ratio, age pyramids/age distribution. (*Any two*)

Q. What is population density? Explain any three different ways the population density can be measured, with the help of an example each.

Ans. Population density: Number of individuals per unit area at a given time/period

i. Biomass/%Cover, *e.g.*, Hundred parthenium plants and 1 huge banayan tree
ii. Relative Density, *e.g.*, Number of fish caught per trap from a lake
iii. Numbers, *e.g.*, Human population

iv. Indirect estimation, *e.g*., without actually counting/seeing them, e.g., tiger census basedon pug marks and faecal pellets.

Q.7. Answer the following questions:

Q. Explain with the help of a graph the population growth curve when resources are

i. limiting and
ii. not limiting.

Ans. There are two models of population growth:

- The exponential growth
- Logistic growth

i. **Exponential Growth**
- The exponential or geometric growth is common where the resources (food + space) are unlimited.
- The equation for exponential growth can be derived as follows:

$$\frac{dN}{dt} = (b - d) \times N,$$

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

$$\frac{dN}{dt} = rN$$

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

i.
- where, N = population size,
  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),
  b = birth rate, and
  d = death rate.
- 'r' is an important parameter assessing impacts of biotic and abiotic factor on population growth.
- In exponential growth, when N in relation to time is plotted on graph, the curve becomes J shaped.

ii. **Logistic growth**
- The resources become limited at certain point of time, so no population can grow exponentially.
- This growth model is more realistic.
- Every ecosystem or environment or habitat has limited resources to support a particular maximum number of individuals called its **carrying capacity (K).**

- When N is plotted in relation to time t, the logistic growth show sigmoid curve and is also called **Verhulst–Pearl logistic growth**. It is given by the following equation:

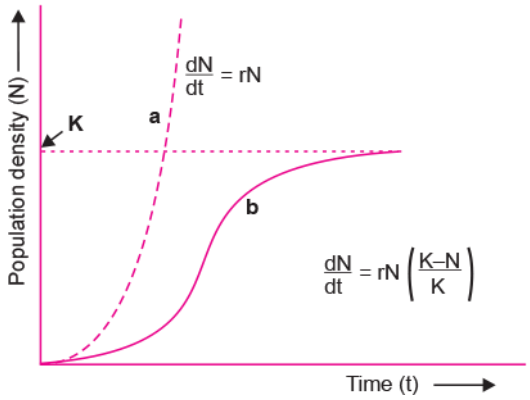
$$\frac{dN}{dt} = rN\left[\frac{K - N}{K}\right]$$

where

N = population density at time t

r = intrinsic rate of natural increase

K = carrying capacity.



Population growth curve: (a) When resources are not limiting the growth, plot is exponential. (b) When resources are limiting the growth, plot is logistic, K is carrying capacity.

Q. "Nature has a carrying capacity for a species." Explain.

Ans.

i. The resources become limited at certain point of time, so no population can grow exponentially.
ii. Every ecosystem or environment or habitat has limited resources to support a particular maximum number of individuals called its carrying capacity (K).

Q.8. Answer the following questions:

Q. Explain giving reasons why the tourists visiting Rohtang Pass or Mansarovar are advised to resume normal 'active life' only after a few days of reaching there.

Ans. Initially the person suffers from altitude sickness/nausea, fatigue and heart palpitation because of low oxygen availability and low atmospheric pressure. Gradually

the body increases RBC production, decreasing binding capacity of Hb and increases the breathing rate to get acclimatised.

Q. It is impossible to find small animals in the polar regions. Give reasons.

Ans. Small birds have larger surface area relative to their volume, so they lose heat much faster, spend more energy to generate body heat.

Q.9. Answer the following questions:

Q. Compare, giving reasons, the J-shaped and S-shaped models of population growth of a species.

Ans.

J-shaped growth curve	S-shaped growth curve
1. It is common where resources are unlimited.	It is common where resources are limited.
2. Growth is exponential.	It is logistic growth.
3. As resources are unlimited all individuals survive and reproduce.	As resources are limited only the fittest individual will survive and reproduce.
4. Growth equation is given by $\frac{dN}{dt} = rN$ where N is population size, t is time, r = intrinsic rate of natural increase	Growth Equation is given by $\frac{dN}{dt} = rN\frac{K-N}{K}$ where N is population density at time t, r = intrinsic rate of natural increase, K = carrying capacity.

Q. Explain "fitness of a species" as mentioned by Darwin.

Ans. When resources are limited is leads to competition between individuals. Eventually the fittest individual will survive and reproduce to leave more progeny.

Q.10. Answer the following questions:

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

Ans. Herbivores are animals feeding on plants. Although they are classed differently they are considered predators. Like predators, for transfer of energy across trophic levels, herbivores also do the same. Besides this, they also keep the population of their prey under control. For example, when the prickly pear cactus was introduced in Australia in early 1920s, they spread rapidly causing havoc. Their population was controlled by introducing cactus-feeding predator (a moth).

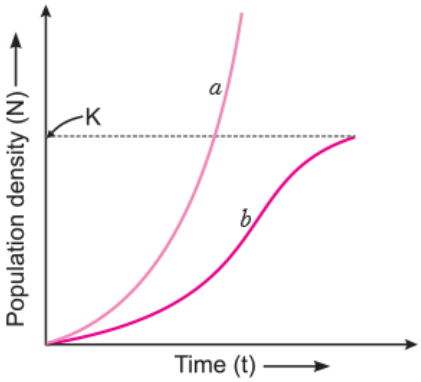
Q. Differentiate between the following interspecific interactions in a population:

i. **Mutualism and Competition**

Ans. (i)

S.No.	Mutualism	Competition
(*i*)	This interaction benefits both the interacting species.	In this interaction, both the interacting species suffer negatively
(*ii*)	The two individuals may be physically or physiologically associated.	There is no physical association between the competitors.
(*iii*)	*E.g.*, Lichens represent mutualism between fungus and algae where fungus absorbs nutrition and provides protection, and algae prepares food.	*E.g.*, In some American Lakes, visiting flamingoes and resident species compete for their common food.

Q.11. Study the graph given below and answer the questions that follow:



i. Write the status of food and space in the curves (*a*) and (*b*).
ii. In the absence of predators, which one of the two curves would appropriately depict the prey population?
iii. Time has been shown on X-axis and there is a parallel dotted line above it. Give the significance of this dotted line.

Ans.

i. a: unlimited food and space
b: limited food and space
ii. Curve *a*
iii. The dotted line represents the carrying capacity. It is the capacity of a given habitat having enough resources to support maximum possible number, beyond which no further growth is possible.

Long Answer Questions (OIQ)

[5 Marks]

Q.1. What is adaptation? Describe the adaptation of plant and animal in desert.

Ans. Adaptation is the quality of the organism (morphological, physiological, behavioural) that enables the organism to survive and reproduce in its habitat. It adapts organisms to live in different types of habitats.

Adaptation of plant and animal in desert:

Adaptations of desert plants are as follows:

i. Desert plants have cuticles to minimise transpiration.
ii. In some desert plants, leaves are modified into spines to minimise loss of water.
iii. They have long roots and adaptations to reduce transpiration, *e.g., Acacia.*

Adaptations of desert animals are as follows:

i. Desert animals have concentrated their urine for minimum loss of water, *e.g.*, Kangaroo rat.
ii. Desert animals absorb heat from the sun, when the body temperature drops below the comfort zone.
iii. They live in burrows during hot season and have little water requirement, *e.g.*, camel.

Q.2. Describe the exponential growth model of a population with diagram and curve.

Ans. Exponential Growth

- The exponential or geometric growth is common where the resources (food + space) are unlimited.
- The equation for exponential growth can be derived as follows:

$$\frac{dN}{dt} = (b - d) \times N,$$

$$\text{Let} \quad (b - d) = r, \text{ then}$$

$$\frac{dN}{dt} = rN$$

$$\text{Or}, \quad N_t = N_0 e^{rt}$$

where, N = population size,
N_t = population density after time t,
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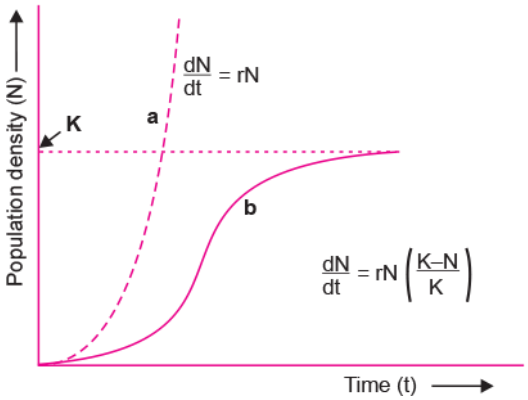
r = intrinsic rate of natural increase,
e = the base of natural logarithms (2.71828),

b = birth rate, and
d = death rate.

- 'r' is an important parameter assessing impacts of biotic and abiotic factor on population growth.
- In exponential growth, when N in relation to time is plotted on graph, the curve becomes J shaped.



Population growth curve: (a) When resources are not limiting the growth, plot is exponential. (b) When resources are limiting the growth, plot is logistic, K is carrying capacity.

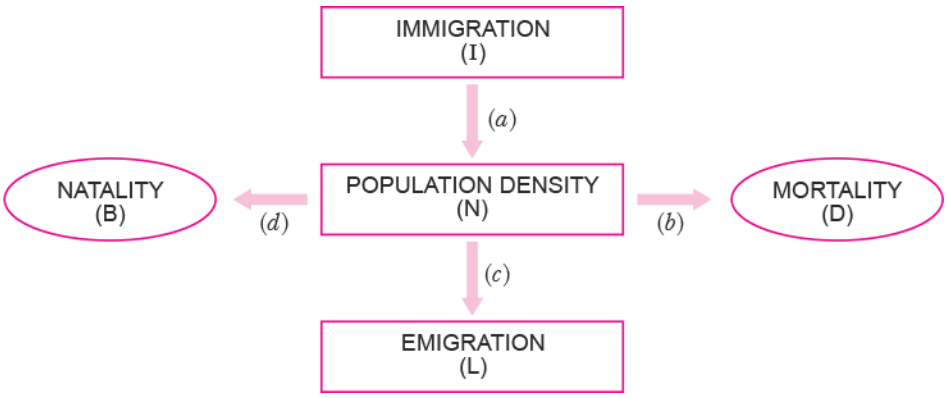
Q.3. What is mutualism? Describe any four examples.

Ans. Mutualism

- Mutualism is referred to as the interspecific interaction in which both the interacting species are benefited.
- Some examples of mutualism

a. Lichens represent close association between fungus and photosynthetic algae or cyanobacteria, where the fungus helps in the absorption of nutrients and provides protection while algae or cyanobacterium prepares the food.
b. Mycorrhizae are close mutual association between fungi and the roots of higher plants, where fungi helps the plant for absorption of nutrients while the plant provides food for the fungus.
c. Mutualism are found in plant–animal relationships. Plants take the help of animals for pollination and dispersal of their seeds and animals are rewarded in the form of nectar or edible pollen or oviposition (site for laying egg).
d. The male bee pseudocopulates with it and during this process of pseudocopulation, the pollen grains are dusted on the body of male bees.
e. With such pollen dusts, male bee pseudocopulates to another flower of the same species and pollination takes place.

Q.4.

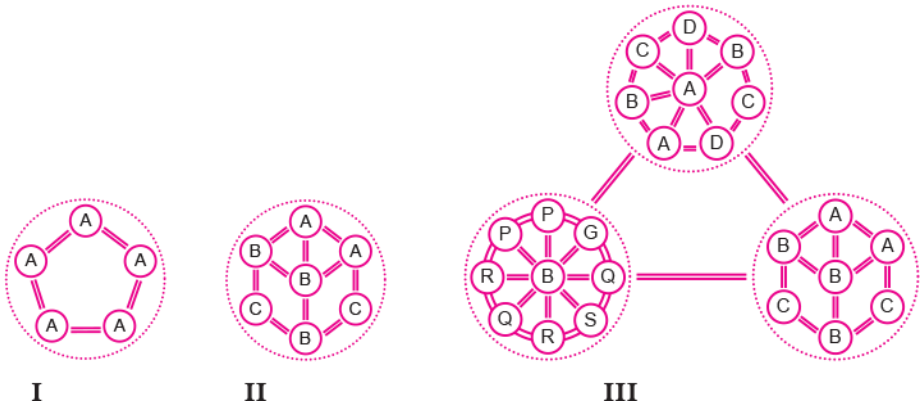


i. Which of the above represents the increase or decrease of population?
ii. If N is the population density at time t, then what would be its density at time (t+1)? Give the formula.
iii. In a barn there were 30 rats. 5 more rats enter the barn and 6 out of the total rats were eaten by the cats. If 8 rats were born during the time period under consideration and 7 rats left the barn, find out the resultant population at time (t+1).
iv. If a new habitat is just being colonized, out of the four factors affecting the population growth, which factor contributes the most?

Ans.

a. *a* and *d* represents increase of population and *b* and *c* represent decrease of population.
b. $N_{t+1} = N_t + [(B + I) – (D + E)]$
c. Here, $N_t = 30$; I = 5; E = 7 ; D = 6; B = 8
Putting the value in $N_{t+1} = N_t + [(B + I) – (D + E)]$
$N_{t+1} = 30 + [(8 + 5) – (6 + 7)]$
$= 30 + [13 – 13]$
$= 30 + 0$
= 30 rats
d. Immigration contributes the most.

Q.5. Comment on the following diagrams:
A, B, C, D, G, P, Q, R, S are species.

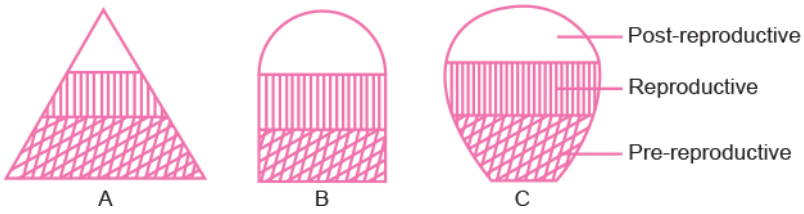


Ans. **Fig. I:** It is a single population and all individuals are of the same species, *i.e.*, A individuals interact among themselves and their environment.

Fig. II: It is a community and it contains three populations of species A, B and C. They interact with each other and their environment.

Fig. III: It is a biome. It contains three communities of which one is in climax and other two are in different stage of development. All three communities arc in the same environment and they interact with each other and their environment.

Q.6. The following diagrams are the age pyramids of different populations. Comment on the status of these populations.



Ans. Fig. A: It is a 'pyramid' shaped age pyramid. In this figure, the base, *i.e.*, pre-reproductive stage is very large as compared with the reproductive and post-reproductive stages of the population. This type of age structure indicate that the population would increase rapidly.

Fig. B: It is an 'inverted bell' shaped pyramid. In this figure, the pre-reproductive and reproductive stages are same. This type of age structure indicates that the population is stable.

Fig. C: It is 'urn' shaped pyramid. In this figure, the pre-reproductive and reproductive stages are less than the post-reproductive stage of this population. In this population more older people are present. This type of age structure indicates that the population definitely is declining.