Population

1 Mark Questions

1.State Gause's competitive exclusion principle. [Ail India 2014]
Ans.Gause's competitive exclusion principle states that two competiting species for same resource cannot co-exist, if all other ecological factors are constant.

2.Write, what do phytophagous insects feed on? [Delhi 2012]
Ans.Phytophagous insects feed on sap and other parts of plants.

3.What is the interaction called between Cuscuta and shoe flower bush? [Delhi 2012]
Ans.The interaction between Cuscutaand shoe flower bush is called parasitism. Here, **Cuscuta** is the parasite which infests the shoe flower bush and derives nutrition from it

4.What is an interaction called when an orchid grows on a mango plant?[Delhi 2012]
Ans.An orchid growing on the branch of a mango tree is an epiphyte. Epiphytes are plants growing on other plants which however, do not derive nutrition from them. Hence, the relationship between a mango tree and an orchid is an example of commensalism.

5.Mention the unique feature with respect to flowering and fruiting in bamboo species. [Delhi 2012]
Ans.Bamboo plants flower only once in their life time, generally after 50-100 years, produce large number of fruits and then die.

6.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. [Delhi 2012]
Ans.

The birth rate of *Hydrilla*

$$= \frac{\text{Number of individuals born}}{\text{Total number of individuals}}$$

$$= \frac{10}{20} = 0.5 \text{ per } \textit{Hydrilla} \text{ plant per year}$$

Birth rate is 0.5 per *Hydrilla* plant or 500/thousand/year. **(1)**

7.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. [All India 2011]
Ans. The wasp uses the ovary for oviposition.It also uses the developing seeds of the fruit to nourish its larvae.

8.Why are cattle and goats not seen browsing on Calotropis growing in the fields? [Foreign 2011]
Ans.Calotropis plant produces poisonous cardiac glycosides. Therefore, cattle or goat do not graze these plants

9. If 8 individuals in a laboratory population of 80 fruitflies died in a week, then what would be the death rate for population for the said period? [Delhi 2010]

Ans.

$$\text{Death rate} = \frac{\text{Number of individual died}}{\text{Total number of individuals}}$$

$$= \frac{8}{80} = 0.1 \text{ individuals/week}$$

Death rate will be 0.1 individuals /week.

10.In a pond, there were 200 frogs.40 more were bom in a year. Calculate the birth rate of the population. [Delhi 2010]

Ans.

The birth rate of frog population

$$= \frac{40}{200} = 0.2 \text{ per frog/year}$$

or 200 per thousand/year.

11.Why do predators avoid eating Monarch butterfly? How does the butterfly develop this protective feature? [Foreign 2010]

Ans. Predators avoid the monarch butterfly as it is highly distasteful to its predators (birds) because of a special chemical present in its body. It acquires this chemical during the caterpillar stage by feeding on a poisonous weed

12.Comment on the interaction between a clown fish living among the tentacles of a sea anemone.[Delhi 2010]

Ans.The interaction between a clown fish living among the tentacles of sea anemone is called commensalism.

13.Comment on the interaction between certain species of fig trees and Wasps. [Delhi 2010c]

Ans. The relation between fig trees and wasps is of mutualism.

14.Name the type of interaction seen between whale and barnacles growing on its back. [Foreign 2009]

Ans. The type of interaction observed between whale and barnacles growing on its back is commensalism.

15.How does camouflage help an insect? [All India 2009 C]

Ans. Camouflage is a prey defence mechanism to avoid being detected easily by the predators.

16.Mention any two significant roles predation plays in nature.[All India 2008]

Ans.Significant roles played by predators are predators keep prey population under control. They help in maintaining species diversity in a community by reducing the intensity of competition

17.List two advantages that a mycorrhizal association provides tO the plant. [All India 2008 C]

Ans. Mycorrhizal association helps plants in

(i) Providing resistance to root borne pathogens.

(ii) Absorbing nutrients.

18.Give one example where population estimation of an organism is done indirectly without actually counting the organism. [All India 2008 c]

Ans.The number of fish caught per trap is a population estimation method done indirectly without actually counting them.

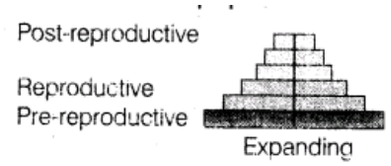
2 Marks Questions

19.Describe the mutual relationship between fig tree and wasp and comment on the phenomenon that operates in their relationship.[All India 2014]

Ans.The relationship between fig tree and wasp shows mutualism. The wasp while searching for sites to lay its eggs, pollinates the fig's inflorescence. On the other hand, the fig not only provides shelter (fruit) for oviposition to wasp but also allows its larva to feed on seeds.

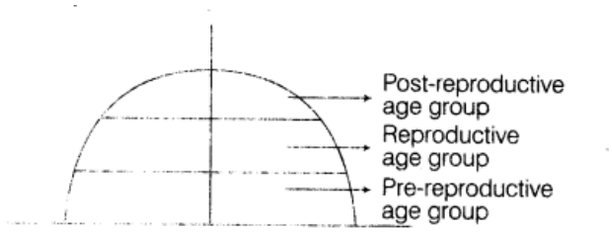
20.Construct an age pyramid which reflects an expanding growth status of human population. [All India 2014]

Ans. The age pyramid geometrically represents the proportions of different age groups in population. The triangular shape of age pyramid represents the expanding growth status of human population.



21.Construct an age pyramid which reflects as stable growth status of human population. [All India 2014]

Ans.**The** age pyramid that reflects a stable growth status of human population can be represented as follows



Bell-shaped age pyramid of stable population

22.Differentiate between commensalism arid mutualism by taking one example each from plants Only. [All India 2014]

Ans. Commensalism is the kind of interaction between species in which one is benefitted and other is neither benefitted nor-harmed. Example of such association is orchid growing as an epiphyte on a mango tree, which remains unaffected by its growth.

Whereas mutualism is the type of interaction in which both the species involved are benefitted. e.g. lichen representing mutual ' association between algae and fungi, in which algae is protected by fungi, which also provides nutrients for synthesis of food, while algae provides food to fungi, as they are incapable of synthesising their own food.

23.Explain Verhulst-Pearl Logistic Growth of a population. [All India 2014]

Ans. The population growing in a habitat with limited resources initially shows a lag phase, followed by exponential phase and finally a declining or stationary phase, when the growth or density of population reaches carrying capacity is called Verhulst-Pearl logistic growth.

It can be explained by following equation

Where, N – Population density at time t.
r – Intrinsic rate of natural increase **K** – Carrying capacity

24.Explain mutualism with the help of an example. [All India 2014]
Ans. The type of interaction where both the species involved are benefitted is called mutualism. For the relationship between fig and wasp is mutualism. The wasp while in search of egg laying sites pollinate the fig's inflorescence, while the fig offers fruit or ovary for oviposition (egg laying). It also offers its seeds to the developing larva

25.Provide two reasons that make the count of prokaryotic species difficult. [All India 2014]
Ans. The two reasons that make the count of prokaryotic species difficult is
(i) they are microscopic not visible by naked eyes.
(ii)they form dense colonies, i.e. population size is so, huge that counting is time taking and almost possible.
(iii) the rate of growth is very fast in prokaryotic species, which may almost double itself while counting

26.How does Monarch butterfly defend itself from predators? Explain.[Delhi 2013 C]
Ans. Predators avoid the monarch butterfly as it is highly distasteful to its predators (birds) because of a special chemical present in its body. It acquires this chemical during the caterpillar stage by feeding on a poisonous weed

27.Why do clown fish and sea anemone pair up? What is this relationship called ? [Delhi 2012; All India 2008]
Ans.Clown fish maintains commensalism with the sea anemone. In this interaction, one species is benefitted and the other is neither harmed nor-benefitted. Sea anemone has stinging tentacles that provide protection to clown fish from predators. The anemone does not appear to derive any benefit from the clown fish

28.Explain brood parasitism with the help of an example. [All India 2012]
Ans.The phenomenon in which one organism(parasite) lays its eggs in the nest of another organism is called brood parasitism. e.g. cuckoo (parasite) lay eggs which resemble the host's (crow) egg in size and colour in crow's nest and let it incubate them.

29.How does the floral pattern of mediterranean orchid Ophrys guarantee cross-pollination?[Delhi 2010; Foreign 2009]
Ans. In the flowers of Ophrys
(i) One petal resembles the female of a bee species in size, colour, markings, etc.
(ii) Male bee perceives it as a female and pseudocopulates with it.
(iii)During the process, the pollen grains from the anthers become dusted on the body of the bee.
(iv)When the bee is attracted to another flower of this orchid species, the process is repeated and the pollen grains from the body of the bee get dusted on the stigma thus, pollination is achieved.

30.How do plants benefit from having mycorrhizal symbiotic association?[Foreign 2010]
Ans. Benefits to plants having mycorrhizal association are:
(i) The fungus absorbs nutrients from the soil and passes it to the plant.
(ii) Mycorrhiza provide resistance to root-borne pathogens.
(iii) They show increased tolerance to salinity and drought.

(iv) An overall increase occurs in plant growth and development.

31.Mention the changes the koel must have undergone in order to achieve brood parasitism, during the course of evolution. [All India 2010C]

Ans.During the course of evolution, the eggs of koel have evolved to resemble the host's (crow) egg in size and colour to reduce the chances of the host bird detecting the koel's eggs and ejecting them out of the nest.

32.Explain the two defense mechanisms evolved in preys to avoid overpopulation of their predator. [Ail India 2010 C]

Ans.Defense mechanism evolved in preys:

(i) To avoid being detected easily by the predators, some species of insects and frogs are cryptically coloured (camouflaged).

(ii) Some plants have thorns or spines for defence mechanism, e.g. Acacia, cactus.

33.Egrets are often seen along with grazing cattle. What do you refer to this interaction? Give a reason for this association. [Delhi 2009]

Ans.The egrets are seen in close association with grazing cattle as the cattle egrets are benefitted by it. Cattle while grazing stir up the bushes and insects are flushed out from the vegetation to be detected by the cattle egrets. This association is called commensalism as cattles are neither benefitted nor-harmed.

34.(i) What is r in the population equation given below dN/dt = rN

(ii)How does the increase and the decrease in the value of r affect the population size? [Delhi 2009]

Ans.(i) r is an intrinsic factor assessing impacts of biotic and abiotic factor on population growth.

(ii) When **r** increases, population size • increases, while a decrease in r decreases the population size

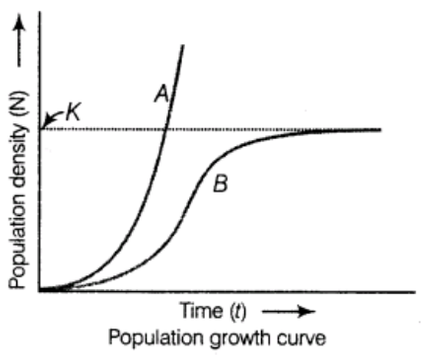
35.(i) How is Cuscuta adapted to be a parasitic plant?

(ii) Why do cattle avoid grazing on Calotropis plants? Explain.[Foreign 2009]

Ans.(i)Cuscutahas lost its chlorophyll during evolution and developed haustoria through which it derives its nutrition from host plant. Thus, it is adapted as a parasitic plant.

(ii) Cattle avoid grazing on Calotropis plants because it produces poisonous cardiac glycosides.

36.Identify the curves A and B shown in the graph given below. List the conditions responsible for growth patterns A and B. [Foreign 2009]



Population growth curve

Ans.A-**Exponential growth curve** When the resources are not limiting, this form of curve appears.

B-**Logistic growth curve** When the resources are limiting, this form of growth curve appears, here **K** is the carrying capacity

37.In a pond, there were 40 lotus plants. After a year, the number rose to 56. Calculate birth rate of a lotus plant.[All India 2009 C]

Ans. The birth rate of lotus plant

$$\text{The birth rate of lotus plant} = \frac{\text{Number of individuals born}}{\text{Total number of individuals}} = \frac{16}{40}$$
$$= 0.4$$

Birth rate is 0.4 per lotus plant per year. **(2)**

38.Name the interaction in each of the following

(i)Cuscuta growing on a shoe flower plant.

(ii)Mycorrhizae living on the roots of higher plants.

(iii)Clown fish living among the tentacles of sea anemone.

(iv)Koel laying her eggs in crow's nest. [All India 2008; Foreign 2008]

Ans.The interactions are identified as:

(i) Parasitism (ii) Mutualism

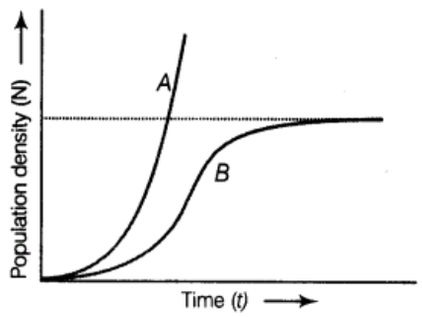
(iii) Commensalism (iv) Brood parasitism

39.Certain species of wasps are seen to frequently visit flowering fig trees. What type of interaction is seen between them and why? [All India 2008]

Ans. Mutualism is seen between them because both are equally benefitted. Female wasps lay eggs in fruits and uses developing seeds within the fruit for nourishing its larvae. In return, the wasp pollinates the fig's inflorescence, while searching for suitable egg laying site.

3 Marks Questions

40. Study the graph given below and answer the questions that follow



(i)Write the status of food ans space in the curves (A) and (J3)

(ii)In the absence of predators, which one of the two curves would appropriately depict the prey population?

(iii)Time has been shows on x-axis and there is a parallel doted line above it. Given the significance of this dotted line. [Delhi 2014]

Ans.(i)The status of food and space in curves 'a' is unlimited resources, while in curve 'b' the sources of food and space are limited.

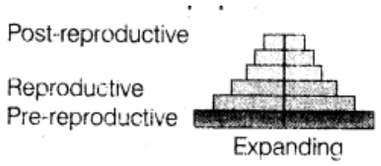
(ii)In the absence of predators, the curve 'B' would appropriately depict the competition for limited food and shelter resources within the prey population.

(iii)The dotted line in the above graph represents the carrying capacity (K). The carrying capacity signifies the limit of habitat, i.e. limited resources in a given habitat to support growth upto a certain level beyond which no further growth can take place

41Draw and explain expanding age pyramids of human population. Why is it so called?

Ans. The age pyramid geometrically represents the proportions of different age groups in population. The triangular shape of age pyramid represents the expanding growth status of

human population.



Expanding age pyramid is so called as it represents the growing status of populations growth.

42.Explain brood parasitism with the help of an example. [Delhi 2013c]

Ans. Brood parasitism is a phenomenon in which one organism (parasite) lays its eggs in the nest of another organism.e.g. eggs of cuckoo (koel) and the crow resemble in size and colour, to reduce the chances of the crow (host) detecting the foreign eggs (cuckoo's) and ejecting them out from the host, cuckoo lay eggs in the crow's nest.

43.(i) Write the importance of measuring the size of a population in a habitat or an ecosystem.

(ii) Explain with the help of an example, how the percentage cover is a more meaningful measure of population size than mere numbers? [All India 2013]

Ans.(i) Measurement of population in a habitat determines the relative abundance of a particular species and its effect on the available resources of that particular habitat.

(ii) The percentage cover is more meaningful measure of population size than mere numbers because the relative abundance of a species is not only determined by number of individuals but by both the relative abundance in biomass and number.

e.g. in a unit area the number of grass species or relative abundance in number is high but not the relative biomass, if the same area has one or two **Ficus bengalensis** tree, it is very low in relative abundance but high in relative abundance of biomass

44.(i)Explain death rate in a population by taking a suitable example.

(ii) Write the other two characteristics, which only a population shows but an individual cannot. [All India 2013]

Ans. Death or mortality rate is expressed as the number of deaths of individual of a population per year.

Example If 80 individuals in a laboratory population of 800 fruit fly died in a week then death rate is 80/800=0.1/fruityfly/week

(ii)Characteristics of population, not exhibited by individual are:

- Population size or density
- Population interactions

45.(i) Explain birth rate in a population by taking a suitable example.

(ii) Write the other two characteristics, which only a population shows but an individual cannot. [All India 2013]

Ans.(i) Due to natality or birth rate, population increases continuously. It is covering the production of new individual by birth, hatching, by asexual mode, etc. It is expressed as the number of birth per 1000 individual of a population per year.

(ii) The characteristic, which are unique to the group (population) and not shown by an individual are.

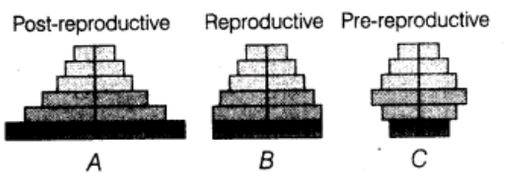
- **Population dynamics** theories to explain population growth. Size of population for any species is not a static parameter.Population growth change during time and depend upon food availability, predation, pressure, weather and also depend upon natality and mortality, immigration, emigration.
- **Regulation of population** Govern population density or population size. It is the number

of individual of a species per unit area or volume

46.(i) List any three ways of measuring population density of a habitat.
(ii) Mention the essential information that can be obtained by studying the population density of an organism.[All India 2013]
Ans.(i)Three ways of measuring population density of a habitat
A- Per cent cover for trees with larger canopy.
B- Number of fishes caught per trap.
C- Pug marks or faecal pellets for tiger census.
(ii) The population density tells us about the status of a species, i.e. the outcome of competition, impact of predation or effect of pesticides, etc.

47.Name the type of interaction seen in each of the following examples
(i)Ascaris worm living in the intestine of human.
(ii)Wasp pollinating fig's inflorescence.
(iii)Clown fish living among the tentacles of sea anemone.
(iv)Mycorrhizae living on the roots of higher plants.
(v)Orchid growing on a branch of mango tree.
(vi)Disappearance of smaller barnacles when Balanus dominated in the coast of Scotland.
[Delhi 2011]
Ans.(i) Parasitism (ii) Mutualism
(iii) Commensalism (iv) Mutualism
(v)Commensalism (vi) Competition

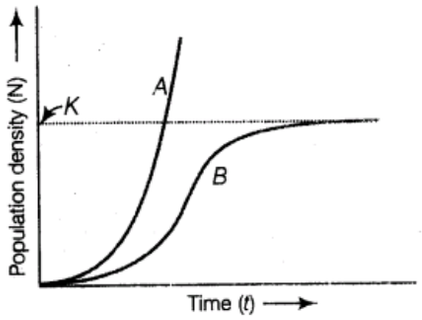
48.Study the three different age pyramids, for human population given below and answer the questions that follow



(i)Write the names given to each of these age pyramids.
(ii)Mention the one which is ideal for human population and why?[Foreign 2011]
Ans.(i) A – Expanding, B – Stable,C -Declining
(ii) Stable population is preferred.It is beneficial for survival and better living of the human population. It is helpful for planning welfare activities.

49.Why is predation required in a community of different organisms?[Foreign 2009]
Ans.Requirement of predation:
(i) Acts as a conduit for energy transfer across trophic levels.
(ii) Keep the prey population under control.
(iii) Helps in maintaining species diversity in a community by reducing the intensity of competition.
(iv) Biological control of pests is based on predation.

50.Study the population growth curves in the graph given below and answer the questions which follow



(i) Identify the growth curves A and B

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

(iii)If

equation of the logistic growth curve, what does K stand for?

(iv)What is symbolised by N?[Delhi 2008]

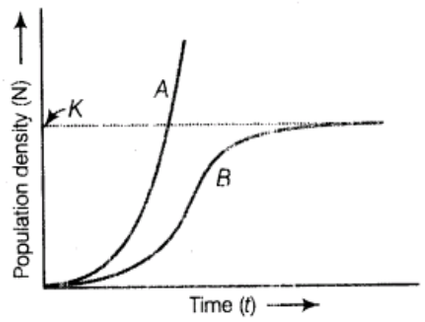
Ans.(i)A – Exponential growth curve B – Logistic growth curve

(ii) Logistic growth curve B is considered more realistic one because the resources are finite and become limiting sooner or later.

(iii) K-stands for carrying capacity. It is the maximum number of individuals of a population, that the given environment can sustain.

(iv) N-symbolises population density. It is the number of individuals in a given population per unit area

51.Study the population growth curves shown below



(i)Identity curves A and B,

(ii)Mention the conditions responsible for the curves A and B respectively,

(iii)Give the necessary equation for the curve B. [All India 2008]

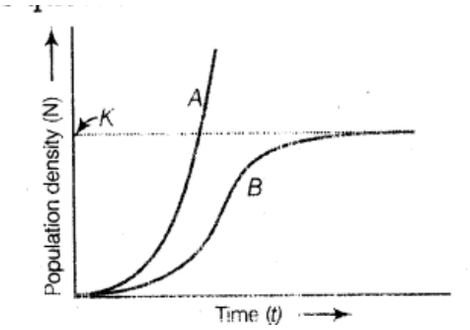
Ans.(i)A-Exponential growth curve B-Logistic growth curve.

(ii) A- Any species growing exponentially under unlimited resource conditions, shows this growth curve.

B- A population growing in a habitat with limited resources shows an initial lag phase, an accelerated log phase and a decelerated steady phase.

(iii)

52.Study the graph below and answer the questions which follow



(i)The curve A is represented by the equation
dN /dt=rN represent in the equation and what is its importance?
(ii)Which one of the two curves is considered a more realistic one for most of the animal population?
(iii)Which curve would depict the population of a species of deer if there are no predators in the habitat? Why is it SO? [Foreign 2008]
Ans.(i) r is intrinsic rate of natural increase. It is an important parameter for assessing the impact of any abiotic or biotic factors on the population growth.
(ii) Curve-B is more realistic for animal population
(iii) Curve-B. When the predators are absent, there will be competition among large prey population for resources.

5 Marks Questions

53.(i) Name the population growth pattern the equation{dN/dt=rN} represents. What does 'r' represent in the equation? Write its importance in population growth.
(ii) Explain the principle of carrying capacity by using population Verhulst-Pearl logistic growth curve. [Delhi 2014 C]
Ans. The logistic growth pattern is represented by equation {dN/dt=rN}
Here Y represents the intrinsic factor a rate of natural increase.Since, the growth for most of the organisms's population becomes limiting due to limited resources, this logistic growth pattern provides a realistic model for study of population growth.
(ii)The Verhulst-Pearl logistic growth curve iexplained by

where, K represents the carrying capacity. It can be referred to nature's limit of natural resources that a habitat provides to its individuals of a growing population, beyond which there is no growth in that particular habitat.

54.What is the association between the bumble bee and its favourite orchid Ophrys? How would extinction or change of one affect he other?[Delhi 2012]
Ans.Mutualism is an association seen between the bumble bee and the orchid In this, both species are benefitted. One petal of its flower bears an uncanny resemblance to the female of the bee in size, colour and markings.
The male bee is attracted to what it perceives as a female and pseudocopulates with the flower. During the process, the bee gets dusted with pollen from the flower. When this same bee pseudocopulates with another flower, it transfers pollen to it and thus, pollinates the flower.
Extinction of bumble bee will definitely affect the orchid flower because these bees are the means of pollination for the flower and if they get extinct, the pollination percentage will be reduced. But, the extinction of the orchid will not affect the bumble bee population.

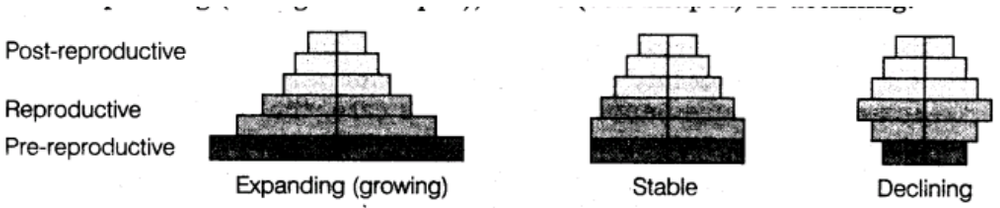
55.(i) What is an age pyramid?
(ii) Explain with the help of figures, the three different types of age pyramids represented by

human population. [Delhi 2011c]

Ans.(i)The graphic representation of the no. of individuals in the different age groups of a population, at a given time is known as age pyramid.

(ii)**Age pyramid**

- When the age distribution (per cent individuals of a given age or age group) is plotted for the population, this is called age pyramid.
- Population at any given time is composed of individuals of different ages.
- 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 that whether it is expanding (triangular shaped), stable (bell-shaped) or declining.



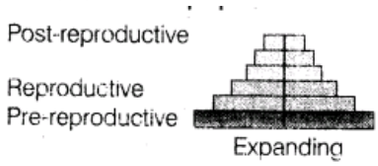
Representation of age pyramids for human population

56.(i) Explain the birth rate and death rate in the population with the help of an example each. (ii) What is age pyramid? Draw an age pyramid of an expanding population. [All India 2011 C]

Ans.(i) The no. of organisms added to a population by birth in a given period is known as birth rate, e.g. if in a pond there are 20 lotus plants last year and through reproduction 8 new plants are added, the birth rate =8/20=0.4 plants per lotus per year.

The no. of individuals removed from a population due to death in a given period of time is called death rate, e.g. if 4 individuals in a lab population of 40 fruit flies died during a specified time interval, say a week, the death rate in the population=4/40=0.1 individuals per fruit fly per week.

(ii)The age pyramid geometrically represents the proportions of different age groups in population. The triangular shape of age pyramid represents the expanding growth status of human population.



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Age pyramid

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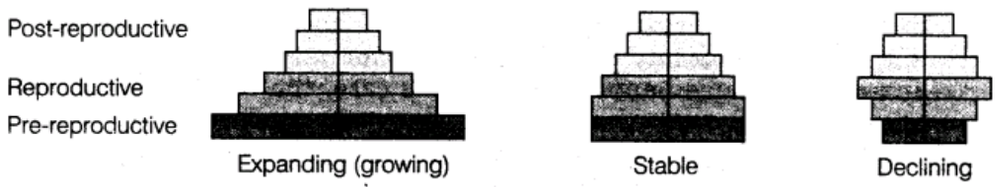
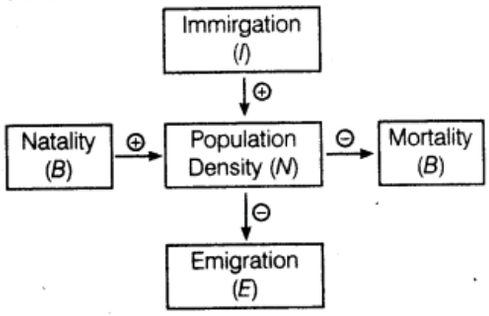


Representation of age pyramids for human population

57.(i) Explain the equation

$N_{t+)}=N_t$ +[{B + 1) − (D − E)] on the basis of the flow chart given below:



(ii)Mention the different ways by which the population density of different species can be measured. [Delhi 2011 c]

Ans.(i)If Nis the population density at time t, then its density at time t +1 is N_t + [(B + 1) -(D -E)]
The population density will increase if the no. of births and the no. of immigrants, i.e. (8 + 1) is more than the no. of death and the no. of emigrants, i.e. (D + 1)

(ii)Three ways of measuring population density of a habitat

A- Per cent cover for trees with larger canopy.

B- Number of fishes caught per trap.

C- Pug marks or faecal pellets for tiger census.

58.Study the table given below and answer the questions that follow

Species A	Species B	Name of interaction
(+)	(+)	A
(–)	(–)	B
(+)	(–)	C
(–)	(0)	D

(+) = Beneficial interaction
(–) = Detrimental interaction
(0) = Neutral interaction

Identify A, B, C and D in the given table and explain any three of them with the help of an example each.[Delhi 2011 C]

Ans.A-Mutualism B-Competition C-Predation D-Amensalism

Mutualism It is an interaction, where both species derive benefit from the interaction, e.g. lichens.

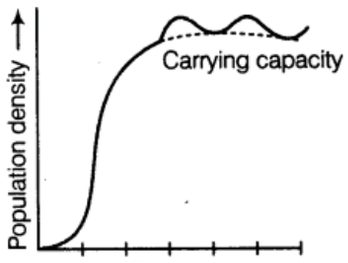
Competition This is an interaction, where both species suffer due to same requirement of resources, that are limited, e.g. In some South American lakes, visiting flamingoes and resident species compete for the common food.

Predation It is an 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, i.e. one is benefitted and other harmed, e.g. tiger and the deer.

Amensalism This is an interaction, where one species is harmed, while other neither benefitted nor harmed, e.g. antibiotics for pathogens.

59.Draw and explain a logistic curve for a population of density (N) at time (it) whose intrinsic rate of natural increase in (r) and carrying capacity (K). [Delhi 2010]

Ans.(i)Population initially shows a lag phase and then shows a phase of acceleration or exponential growth followed by phase of deceleration



Logistic curve

(ii)Population can grow exponentially for a certain period of time and then assumes a steady state, as the resource availability becomes limited at some point of time.

(iii)Every environment has resources to support a particular maximum number of individuals, called its carrying capacity. Beyond that, there is no increase in the size/density of a population.

(iv)A population showing logistic growth shows a sigmoid curve, when the number of individuals is plotted as a function of time

(v)Equation can be described as

where, N = Population density at time t, r = Intrinsic rate of natural increase,

K = Carrying capacity

(vi)The model is more realistic in nature, because no population can sustain the exponential growth indefinitely.

60.(i) Why are herbivores considered similar to predators in the ecological context? Explain.

(ii) Differentiate between the following interspecific interactions in a population

(a)Mutualism and competition

(b)Commensalism and amensalism [All India 2010]

Ans.(i)Herbivores feed on plants. They are considered as predators because they also transfer energy across the trophic levels. 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 1920, they spread rapidly causing havoc.Their population was controlled by introducing cactus-feeding predator (a moth).

(ii) (a) Differences between mutualism and competition are

Mutualism	Competition
It benefits both the interacting species.	Both the interacting species suffer.
Two individuals may be physically or physiologically associated.	No physical association between competitors.
Lichens represent mutualism between fungus and algae, where fungus absorbs nutrition and provides protection while algae prepare food.	In some South American lakes, visiting flamingoes and resident species compete for the common food.

(b) Difference between commensalism and amensalism is:

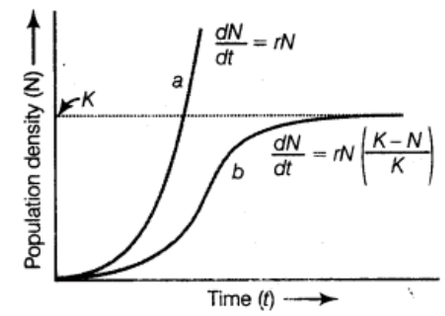
Commensalism	Amensalism
Interaction between two species where one species is benefitted and the other is neither harmed nor benefitted.	Interaction between two different species, in which one species is harmed and the other is neither benefitted nor harmed.
Example an orchid growing as an epiphyte on a mango tree benefits by getting shelter and nutrition but the mango tree is not harmed or benefitted.	Example *Penicillium* produces a toxin killing other microorganisms but is not affected itself.

61.(i) Explain with the help of a graph the population growth curve when resources are (A) limiting (B) not limiting.

(ii) Nature has a carrying capacity for a species. Explain. [Foreign 2010]

Ans.

(i)



Population growth curve

(a)**Resources are limiting** The population growth curve is sigmoid. It is represented by the equation

where, N = Population density at time t, r – Intrinsic rate of natural increase

K = Carrying capacity

(b)**Resources are unlimited** The population growth curve is J-shaped. It is represented by the equation

$dN/dt = rN$ or $N_t = N_0e^n$

where, 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 logarithm (2.71828).

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