Organisms and Populations

Case Study Based Questions

Case Study 1

Habitats of Organisms

Organism P has thick lips and tongue so that it can easily feed on the commonly available spiny plants. Organism Q has thick layer of insulating fat under the skin. It was strong hooves to walk steadily on steep surfaces and lives in burrows during winters. Organism R has bright colours and sticky pads on its fingers and toes. It lives on trees.

Q1. Which of the following is correct habitat for organism P regarding its adaptation?

a. Grassland biome
b. Desert biome
c. Tropical rainforest
d. Tropical deciduous forest

Q2. Which of the following is correct match regarding organism Q and its habitat?

a. Tundra - Polar bear
b. Tropical rain forest - Deer
c. Grassland - Bighorn sheep
d. Desert – Camel

Q3. Which of the following is incorrect regarding organism R's habitat?

a. The vegetation shows stratification.
b. Epiphytic growth is rich.
c. Standing crop is highest.
d. Deep rooted shrubs are common due to abundant sunlight.

Q4. The dominant plants in habitat where P lives could be:

a. Opuntia
b. Nymphaea
c. Deodar
d. Both a. and c.

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Answers

1. (b)
2. (a)
3. (d)
4. (a)

Case Study 2

Population Interaction

During teaching about various environmental factors, a teacher draws a figure that depicts like history strategies for three plant species (X, Y and Z) along 3 axes strength of competition with other organisms, level of disturbance in the habitat and level of environmental stress in the habitat. Species X grows in habitats where competition among species is high, but disturbance and stress are low. Species Y grows in habitats with high environmental stress but with low intraspecies competition. Species Z grows in highly disturbed habitats with low environmental stress.

Q1. Which of the following is correct regarding plant type X?

a. It has slow growth rate.
b. It lives in area with high probability of severe environmental changes.
c. It has good competitive ability at low population densities near the carrying capacity.
d. None of the above.

Q2. Environmental stress occurs through:

a. very low temperature
b. drought
c. nutrient deficiency
d. All of these

Q3. Select the correct option regarding plant type X, Y and Z.

a. X type of plants is likely to be trees
b. Y type of plants could be desert plants
c. Z type of plants could be herbaceous plant
d. All of the above

Q4. Y type of plants grow under high stress and:

a. produce large number of seeds in a short time after rains

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b. have rapid growth
c. Both a. and b.
d. produce less number of seeds in a long time after rain

Q5. Assertion (A): Plant growth rate is high in areas of high stress and high disturbance.
Reason (R): High stress and high disturbance promote breeding capacity in plants.
a. Both Assertion and Reason are true, and Reason is the correct explanation of Assertion.
b. Both Assertion and Reason are true, but Reason is not the correct explanation of Assertion.
c. Assertion is true, but Reason is false.
d. Both Assertion and Reason are false.

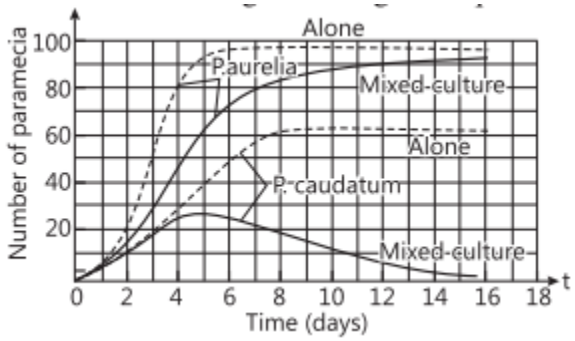
Answers

1. (a)
2. (d)
3. (d)
4. (a)
5. (d)

Case Study 3

Observe the graph given below:

The graph represents inter-specific interaction between two species of Paramecia competing for the same resource in a culture medium. Paramecium caudatum and Paramecium aurelia were grown in separate cultures as well as in mixed cultures. It was found that each species grew in numbers according to the logistic equation.



Q1. Which species is competitively superior? Support it with the data provided in the graph.

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Ans. P. aurelia species is competitively superior. P. aurelia grows in numbers more quickly than P. caudatum and shows more individuals in the same volume of culture/100 Paramecium aurelia in 6 days whereas
60 P. caudatum in 8 days.

Q2. State the underlying principle for the above result and name the scientist associated with this principle.

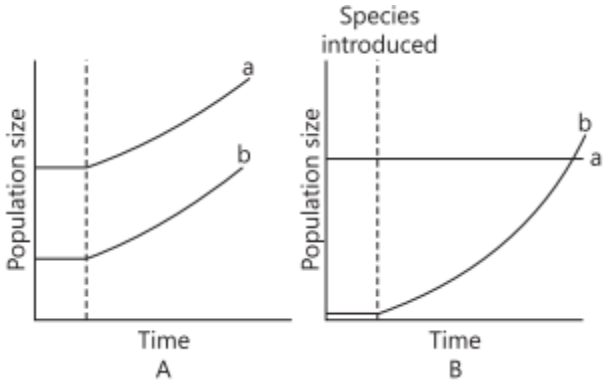
Ans. Competitive Exclusion Principle is the underlying principle which states that two closely related species competing for the same resources cannot co-exist indefinitely and the competitively inferior one will be eliminated.
G.F. Gause is the scientist associated with this principle.

Q3. Explain the mechanism in which two or more species competing with each other can co-exist.

Ans. One such mechanism is 'resource partitioning'. If two species compete for the same resource, they could avoid competition by choosing different times for feeding or different foraging patterns, to avoid competition and co-exist due to behavioural differences in their foraging activities.

OR

Graphs A and B shown below depict interaction of two species. Which graph indicates Mutualism? Give reason. (CBSE SQP 2023-24)



Ans. Graph A- As both species grow simultaneously.

Case Study 4

Population Growth

Growth of a population with time shows specific and predictable patterns. two types of growth pattern of population are exponential and logistic growth. When resources in the

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habitat are unlimited each species has the ability to realise fully its innate potential to grow in number. Then the population grows in exponential fashion. When the resources are limited growth curve shows an initial slow rate and then it accelerates and finally shows giving the growth curve which is sigmoid.
Read the given passage carefully and give the answer of the followings questions:

Q1. Give the equation which represents the exponential population growth curve.
Ans. If any species is flourishing under unlimited resources, it would reach exponential growth which can be depicted by equation:

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

Where N = population density at time; r = intrinsic rate of natural increase.
If we derive the integral form of the exponential growth equation, if can be written as
N_1 = Noert
Where, N = population density after time t; No = population density at time zero; r = intrinsic rate of natural increase; e is the base of natural logarithm.

Q 2. Give Verhulst-Pearl logistic growth equation.
Ans. The logistic growth model is given by:
dN/dt = rN (1-N/K)
Where, N is the number (density) of individuals at time t, K is the carrying capacity of the population and r is the intrinsic growth rate of the population.

Q3. Why is the exponential growth curve be considered as more realistic than the logistic growth curve?
Ans. Since resources of growth for most animal populations are finite and become limiting sooner or later, so the logistic growth model is considered as more realistic.

OR

Name the types of model to measure the growth of population.
Ans. There are two models used to measure the growth of population:
(i) Exponential growth
(ii) Logistic growth.

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Solutions for Questions 5 to 14 are Given Below

Case Study 5

Read the following and answer any four questions from 1(i) to 1(v) given below:

Unlike animals, plants cannot runaway for their defence, therefore, they have evolved an astonishing variety of morphological and chemical defences against herbivores. Thorns are the most common morphological means of defence. Many plants produce and store chemicals that make the herbivore sick when they are eaten, inhibit feeding or digestion, disrupt its reproduction or even kill it. Some plants produce highly poisonous chemicals and that is why no cattle or goats browse on those plants. A wide variety of chemical substances that we extract from plants on a commercial scale are produced by them actually as defence against grazers and browsers.

(i) Why you never see cattle or goats browsing on weed *Calotropis*?

(a) It produces highly poisonous tannins.
(b) It produces quinine which is bitter in taste.
(c) It produces poisonous cardiac glycosides.
(d) It bears prickles.

(ii) What could be the possible reason for invasive growth of the prickly pear cactus introduced in Australia?

(a) Absence of predators (b) New mycorrhizal association
(c) Abundant water availability (d) All of these

(iii) Which of the following is most likely to sick by consuming chemicals produced by plants?

(a) Frog (b) Goat (c) Human (d) Pigeon

(iv) Plant evolve variety of morphological and chemical defences against

(a) prey (b) predator (c) commenal (d) mutualist.

(v) **Assertion :** Some plant functions as predator in nature.
Reason : Phytophagous insects feed on plant sap.

(a) Both assertion and reason are true and reason is the correct explanation of assertion.
(b) Both assertion and reason are true but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

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Case Study 6

Read the following and answer any four questions from 2(i) to 2(v) given below:

Kangaroo rat seldom drinks water. It has thick coat to minimise evaporative desiccation. The animal seldom comes out of its comparatively humid and cool burrow during the day time. 90% of its water requirement is met from metabolic water (water produced by respiratory breakdown of fats) while 10% is obtained from its food. Loss of water is minimised by producing nearly solid urine and faeces. As the animal faces acute water scarcity, it develops two types of adaptations : reducing water loss and ability to tolerate desert conditions.

(i) Kangaroo rat is a

(a) partial regulators
(b) partial conformer
(c) regulator
(d) conformer.

(ii) Metabolic water refers to

(a) water required for metabolic activities
(b) water present in intercellular fluid
(c) water produced during oxidation of fat or carbohydrate
(d) water taken in, to promote metabolism.

(iii) Desert animals minimise water loss by

(a) producing highly concentrated urine
(b) promoting maximum reabsorption of water in kidney tubules
(c) possessing one of the longest loop of Henle in kidney tubules
(d) all of these.

(iv) **Assertion :** Kangaroo rat can tolerate and thrive in wide temperature range and is known as stenothermal.
Reason : Kangaroo rats go into hibernation during winter to escape cold weather.

(a) Both assertion and reason are true and reason is the correct explanation of assertion.
(b) Both assertion and reason are true but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

(v) The adaptations in an organism are meant for

(a) optimum primary production
(b) optimum life span
(c) optimum mobility
(d) optimum survival and reproduction.

Case Study 7

Read the following and answer any four questions from 3(i) to 3(v) given below:

Organism P has thick lips and tongue so that it can easily feed on the commonly available spiny plants. Organism Q has thick layer of insulating fat under the skin. It was strong hooves to walk steadily on steep surfaces and lives in burrows during winters. Organism R has bright colours and sticky pads on its fingers and toes. It lives on trees.

(i) Which of the following is correct habitat for organisms P regarding its adaptation?

(a) Grassland biome
(b) Desert biome
(c) Tropical rainforest
(d) Tropical deciduous forest

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(ii) Which of the following is correct match regarding organism Q and its habitat?

(a) Tundra - Polar bear
(b) Tropical rain forest - Deer
(c) Grassland - Bighorn sheep
(d) Desert - Camel

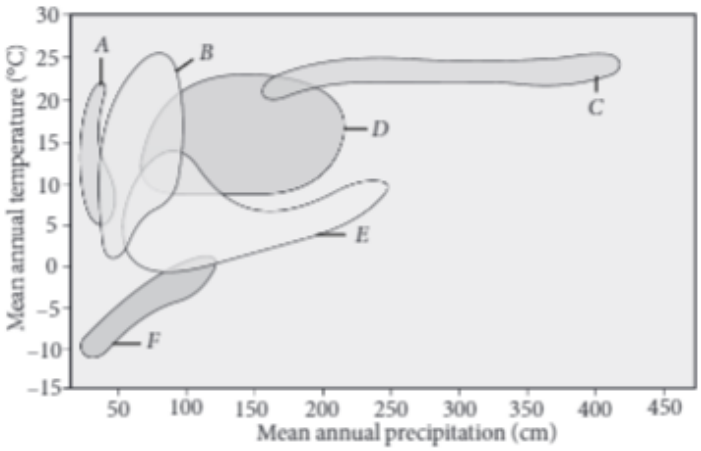
(iii) Which of the following is incorrect regarding organisms R's habitat?

(a) The vegetation shows stratification
(b) Epiphytic growth is rich
(c) Standing crop is highest
(d) Deep rooted shrubs are common due to abundant sunlight

(iv) The dominant plants in habitat where P lives could be

(a) *Opuntia* (b) *Nymphaea* (c) *Deodar* (d) both (a) and (c).

(v) Organisms P, Q and R respectively most likely occur in

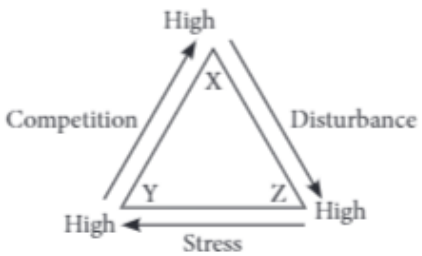


(a) F, B and A (b) C, A, E (c) A, F and C (d) B, D and A.

Case Study 8

Read the following and answer any four questions from 4(i) to 4(v) given below:

During teaching about various environmental factors, a teacher draw a figure that depicts like history strategies for three plant species (X, Y and Z) along 3 axes - strength of competition with other organisms, level of disturbance in the habitat and level of environmental stress in the habitat. Species X grows in habitats where competition among species is high but disturbance and stress are low. Species Y grows in habitats with high environmental stress but with low intraspecies competition. Species Z grows in highly disturbed habitats with low environmental stress.



(i) Which of the following is correct regarding plant type X?

(a) It has slow growth rate.
(b) It lives in area with high probability of severe environmental changes.
(c) It has good competitive ability at low population densities near the carrying capacity.
(d) None of these

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(ii) Environmental stress occurs through
(a) very low temperature (b) drought (c) nutrient deficiency (d) all of these.

(iii) Select the correct option regarding plant type X, Y and Z.
(a) X type of plants are likely to be trees.
(b) Y type of plants could be desert plants.
(c) Z type of plants could be herbaceous plant.
(d) All of these

(iv) Y type of plants grow under high stress and
(a) produce large number of seeds in a short time after rains
(b) have rapid growth
(c) produce less number of seed in a long time after rain
(d) both (a) and (b).

(v) **Assertion :** Plant growth rate is high in area of high stress and high disturbance.
Reason : High stress and high disturbance promote breeding capacity in plants.
(a) Both assertion and reason are true and reason is the correct explanation of assertion.
(b) Both assertion and reason are true but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

Case Study 9

Read the following and answer any four questions from 5(i) to 5(v) given below:
Regular change in temperature that occurs at specific intervals of time is called thermoperiodicity. It is of two types-diurnal and seasonal thermoperiodicity. Diurnal periodicity refers to temperatures of day and night. It determines periods of annual activity. In season periodicity different temperature prevails in different seasons of the year. They favour different aspects of plant and animal life termed as phenology. For example in wheat, leaf growth requires a temperature of 10°-25° C. Apple requires temperature below 7°C for a period of 800 hrs before flowering and fruiting can occur. Low temperature is required for germination of some seeds as well as flowering in some plants. It also determines growth, reproduction, colour and morphology of animals. Both low and high temperature cause stress in organisms which is overcome by particular adaptations.

(i) Some plants require low temperature treatment for flowering. This phenomenon is known as
(a) photoperiodism (b) vernalisation (c) thermoperiodism (d) none of these.

(ii) Animals found in arctic zones are called
(a) microtherms
(b) megatherms
(c) mesotherms
(d) hekistotherms.

(iii) Which of the following parts of wheat plant grows maximum in temperature around 10°-25°C?
(a) Root (b) Seeds (c) Leaf (d) Stem

(iv) "Different temperatures prevail in different seasons of the year." It represents
(a) diurnal thermoperiodicity
(b) seasonal periodicity
(c) homeostasis
(d) thermoregulation.

(v) **Assertion :** Low and high temperature causes stress in organisms.
Reasons : Organisms show specific adaptations to overcome stressful condition.
(a) Both assertion and reason are true and reason is the correct explanation of assertion.
(b) Both assertion and reason are true but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

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Case Study 10

Read the following and answer any four questions from 6(i) to 6(v) given below:
In many species of fig trees, there is a tight one-to-one relationship with the pollinator species of wasp. It means that a given fig species can be pollinated only by its 'partner' wasp species and no other species. The wasp pollinates the fig inflorescence while looking for suitable egg-laying sites. In return for the favour of pollination, the fig offers the wasp some of its developing seeds as food for the developing wasp larvae.

(i) The interaction between fig trees and wasp is an example of
(a) mutualism (b) commensalism (c) amensalism (d) parasitism.

(ii) All the given interactions are similar to interaction between fig trees and wasp, except
(a) plant and animal relation for pollination
(b) association of algae and fungi in lichens
(c) association of cattle egret and grazing cattle
(d) association of fungi and roots of higher plants in mycorrhiza.

(iii) In which of the following interactions both partners are adversely affected?
(a) Parasitism (b) Mutualism (c) Competition (d) Predation

(iv) In relationship between fig and wasp
(a) one benefitted other harmed
(b) both are benefitted
(c) one benefitted other unaffected
(d) one inhibited, other unaffected.

(v) **Assertion :** Fig and wasp cannot complete their life cycle without each other.
Reason : They show mutualistic relationship.
(a) Both assertion and reason are true and reason is the correct explanation of assertion.
(b) Both assertion and reason are true but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

Case Study 11

Read the following and answer any four questions from 7(i) to 7(v) given below:
A desert lizard (an ectotherm) and a mouse (an endotherm) are placed inside a chamber at 15°C and their body temperature [T(L) for the lizard and T(M) for the mouse] and metabolic rates [M(L) for lizard and M(M) for the mouse] are monitored.

(i) Which of the following is correct regarding T(L), M(L), T(M) and M(M)?
(a) T(L) and M(L) will fall while T(M) and M(M) will increase
(b) T(L) and M(L) will increase while T(M) and M(M) will fall
(c) T(L) and M(L) will fall, T(M) will remain same and M(M) will increase
(d) T(L) and M(L) will remain same, T(M) and M(M) will decrease

(ii) It can be said that some animals in their evolutionary development preferred to be ectotherms than endotherms. Which of the following can be the best suited reason for it?
(a) The metabolic reactions of these organisms can occur at a very wide range of temperature.
(b) Maintaining homeostasis is an energetically expensive process.
(c) The enzymes of these organisms are functional at high temperatures.
(d) Both (b) and (c)

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(iii) Organisms that can maintain a constant internal temperature are called

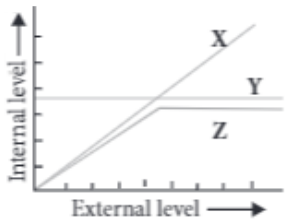
(a) homoeothermic (b) poikilothermic (c) oligothermic (d) heterothermic.

(iv) An animal that survives at temperature of 10°C and 40°C both can be placed under the category of

(a) ectotherm (b) endotherm

(c) modifiers (d) migratory organisms.

(v) Study the graph carefully and select the correct option.



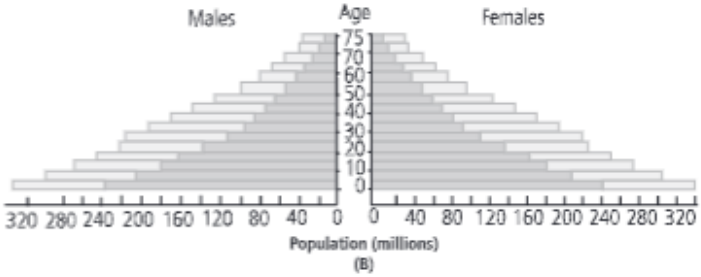
(a) X could be desert lizard. (b) Y could be mouse.

(c) Z could be desert lizard. (d) Both (a) and (b)

Case Study 12

Read the following and answer any four questions from 8(i) to 8(v) given below:

Age sex structure of a population can be depicted in the form of a pyramid by plotting the percentage of population of each sex in each age class. Two age sex pyramids are as follows.



(i) Which of the following is correct regarding pyramid B?

(a) It represents stable population. (b) It represents expanding population.

(c) It represents declining population. (d) Both (a) and (b)

(ii) Total number of individuals of a species per unit area per unit time is called

(a) population size (b) population density

(c) demography (d) population dynamics.

(iii) Which of the following is correct regarding age sex pyramid A and B?

(a) A represents the age sex pyramid of developed country.

(b) B represents the age sex pyramid of developing country.

(c) A represents rapidly growing population.

(d) Both (a) and (b)

(iv) A population with a large proportion of older individuals than younger ones will likely to

(a) grow larger first and then decline (b) continue to grow indefinitely

(c) decline (d) none of these.

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(v) **Assertion :** Bell shaped age pyramid represents a stable population.
Reason : In a stable population, proportion of individuals in reproductive age group is higher than the individuals in pre-reproductive age group.

(a) Both assertion and reason are true and reason is the correct explanation of assertion.
(b) Both assertion and reason are true but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

Case Study 13

Read the following and answer any four questions from 9(i) to 9(v) given below:

Growth of a population with time shows specific and predictable patterns. Two types of growth pattern of population are exponential and logistic growth. When resources in the habitat are unlimited each species has the ability to realise fully its innate potential to grow in number. Then the population grows in exponential fashion. When the resources are limited growth curve shows an initial slow rate and then it accelerates and finally slows giving the growth curve which is sigmoid.

(i) Which of the following statement is incorrect?
(a) Exponential growth occurs in organism such as lemmings.
(b) Logistic growth is more realistic.
(c) Exponential growth has two phases lag and log.
(d) In logistic growth, population passes well beyond the carrying capacity of ecosystem.

(ii) Which of the following equations correctly represents the exponential population growth curve?
(a) $dN/dt = rN$
(b) $dN/dt = rN\left(\frac{K-N}{K}\right)$
(c) $N_t = N_o e^{rt}$
(d) Both (a) and (c)

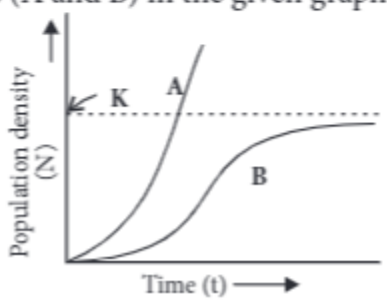
(iii) Which of the following equations correctly represents Verhulst-Pearl logistic growth?
(a) $dN/dt = rN\left(\frac{K-N}{K}\right)$
(b) $dN/dt = \frac{rN}{K}$
(c) $dN/dt = \frac{N(K-N)}{K}$
(d) $dN/dt = \frac{r(K-N)}{K}$

(iv) The population growth is generally described by the following equation:

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

What does 'r' represent in the given equation?
(a) Population density at time 't'
(b) Intrinsic rate of natural increase
(c) Carrying capacity
(d) The base of natural logarithm

(v) Study the population growth curves (A and B) in the given graph and select the incorrect option.



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(a) Curve 'A' shows exponential growth, represented by equation $\frac{dN}{dt} = rN$. .

(b) Curve 'B' shows logistic growth, represented by equation $\frac{dN}{dt} = rN\left(\frac{K-N}{K}\right)$.

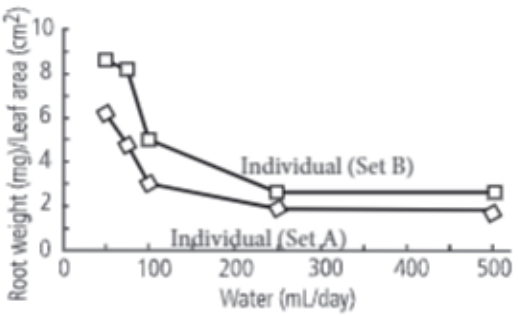
(c) Exponential growth curve is considered as more realistic than the logistic growth curve.

(d) Curve 'A' can also be represented by equation $N_t = N_0 e^{rt}$.

Case Study 14

Read the following and answer any four questions from 10(i) to 10(v) given below:

Ananya is a biologist, her research guide assigned project, *i.e.*, to determine the effect of intra-specific competition on the growth of sapling of *Eucalyptus*. For this, she designed an experiment in which two sets of pots were used. In the first set (set A) only 1 sapling was planted per pot and in the other set (set B) 16 saplings were planted per pot. To check for the effect of intra-specific competition on allocation of resources, a decreasing amount of water was added to each set. The results have been graphically indicated. Which of the following conclusions can indicated as follows :



(i) Which of the following statements can be concluded from the given study?

(a) More resources are allocated to the root during low water conditions.

(b) Competition for water among individuals of a population causes more root growth as compared to individuals who are growing alone.

(c) Lesser leaves are formed under low water conditions.

(d) Root growth is higher in individual grown singly as compared to individuals in populations.

(ii) Which of the following associations is an example of competitions?

(a) *Cuscuta* and hedge plant (b) *Balanus and Cathamalus*

(c) Cactus and moth (d) Orchid and mango

(iii) If '+ ' sign is assigned to beneficial interaction, '–' sign to detrimental and 0 sign to neutral interaction, then the population interaction of competition refers to

(a) +, + (b) –, – (c) +, – (d) +, 0.

(iv) Intraspecific competition is more severe due to

(a) similar needs (b) similar adaptations (c) common resources (d) all of these.

(v) **Assertion :** Two members of a competing species may co-exist.
Reason : Different individuals of a species have different resource requirements.

(a) Both assertion and reason are true and reason is the correct explanation of assertion.

(b) Both assertion and reason are true but reason is not the correct explanation of assertion.

(c) Assertion is true but reason is false.

(d) Both assertion and reason are false.

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5. (i) (c) : Some plants produce highly poisonous cardiac glycosides and that is why no cattle or goats browse on these plants.
(ii) (a)
(iii) (b) : Many plants produce and store chemicals which make herbivores sick when they are eaten.
(iv) (b)
(v) (b) : Few plants are predator in nature, such as carnivorous or insectivorous plants *e.g.*, *Utricularia*, *Drosera*, etc.

6. (i) (c) : Kangaroo rat is a regulator that performs homeostasis through thermoregulation osmoregulation by physiological adjustments and behavioural changes.
(ii) (c)
(iii) (d)
(iv) (d) : Organisms that can tolerate and thrive in wide temperature range are known as eurythermal. Kangaroo rats do not go into hibernation rather, they stay in cool moist burrows during summer days.
(v) (d) : Adaptation is an attribute of an organism (morphological, physiological and behavioural) that enables it to survive and reproduce in its habitat. Adaptations lead to the formation of some specialised and peculiar features which have evolved over a long period of time through natural selection.

7. (i) (b) : P is camel adapted to desert conditions as it has thick lips and tongue so that it can easily feed on the commonly available spiny plants.
(ii) (a) : Q is polar bear as it has thick insulating fat layer under the skin.
(iii) (d) : R could be poison dart frog as it has bright colours and sticky pads on its fingers and toes and its habitat is tropical rainforest. Deep rooted shrubs are not found in tropical rainforest. These are found in deserts.
(iv) (a) : Habitat of P is desert, so, the dominant plant is *Opuntia*.
(v) (c)

8. (i) (a) : 'X type' of plants are competitors which live under condition of low stress and low disturbance and have good competitive ability at high population densities near the carrying capacity. Such plant have slow growth rate and prevail in non-seasonal tropics where there is low probability of severe environmental changes.
(ii) (d) : Environmental stress occurs through external conditions such as shading, drought, nutrient deficiency or very low temperature that limit production.
(iii) (d)
(iv) (a)
(v) (d) : Plant growth rate is low in area of high stress and high disturbance. High stress and high disturbance cannot promote breeding capacity in plants.

9. (i) (b)
(ii) (d) : Organisms living in tropical, subtropical, temperate and arctic zones are megatherms, mesotherms, microtherms and hekistotherms respectively.
(iii) (c)
(iv) (b) : Different temperatures prevail in different seasons of the year represent seasonal periodicity.
(v) (b)

10. (i) (a) : Mutualism is an interaction between two organisms of different species in which both the partners are benefitted, with none of the two capable of living separately. In many species of fig trees there is a relationship with the pollinator species of wasp. The female wasp uses the fruit not only as an oviposition site but also uses the developing seeds within the fruit

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for nourishing its larvae. The wasp pollinates the fig inflorescence, while searching for suitable egg-laying sites. The fig returns this favour of pollination by offering the wasp some of its developing seeds, as food for the developing wasp larvae.

(ii) (c) : The relationship between fig trees and wasp is mutualism whereas relationship between cattle egret and grazing cattle is commensalism.

(iii) (c) : Competition is the rivalry between two or more organisms for obtaining the same resource such as food, light, water, space, shelter, mate, etc. Competitors adversely affect each other.

(iv) (b)

(v) (a) : *Refer to answer 6(i).*

11. (i) (c)

(ii) (b): Maintaining homeostasis, especially thermo-regulation is energetically expensive for many organisms. During the course of evolution, the costs and benefits of maintaining a constant internal environment were taken into consideration and thus some species preferred to be ectotherms.

(iii) (a): Animals with constant body temperature are called homoeotherms. They have insulating coat to check the loss of body heat. This coat consists of hair in most mammals, blubber (subcutaneous fat) in whales and seals and feathers in birds. Shivering warms up the body and perspiration cools down the body of these animals when required. These are also called endotherms as they regulate their body temperature by physiological means and maintain more or less constant internal temperature. Poikilotherms are cold-blooded animals which are unable to regulate their body temperature which changes with change in temperature of environment, *e.g.*, fish, frog, lizards. They are also called ectotherms.

(iv) (b)

(v) (d) : In the given graph X, Y and Z represent conformers, regulators and partial regulators respectively. Desert lizard and mouse are conformer and regulator respectively.

12. (i) (b)

(ii) (b) : Population density is the number of individual present per unit area at a given time.

(iii) (d) : A represents nearly stable population whereas B represents rapidly growing population.

(iv) (c) : A population with large number of older individuals than younger ones is likely to decline since older individuals do not take part in reproduction.

(v) (c) : In a bell-shaped age pyramid, the number of pre-reproductive and reproductive individuals is almost equal. Post-reproductive individuals are comparatively fewer. It represents a stable population.

13. (i) (d) : In logistic growth population seldom grows beyond the carrying capacity of ecosystem.

(ii) (d) : If any species is flourishing under unlimited resources, it would reach exponential growth which can be depicted by equation:

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

Where, N = population density at time t; r = intrinsic rate of natural increase.

If we derive the integral form of the exponential growth equation, it can be written as

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

Where N_t = population density after time t; N_0 = population density at time zero; r = intrinsic rate of natural increase; e is the base of natural logarithm.

(iii) (a)

(iv) (b)

(v) (c) : Since resources of growth for most animal populations are finite and become limiting sooner or later, so the logistic growth model is considered as more realistic.

14. (i) (b): Competition is a sort of rivalry among two or more organisms for obtaining the same resources. The competition among individuals of the same species is called intraspecific competition and among members of different species is called interspecific competition. Intraspecific competition is more severe than interspecific competition due to similar needs. Now, according to the given graph, competition for water in a population leads to more root weight (mg) per leaf area (cm^2). This is because competition causes more root growth so that each sapling can derive more water from the pot.

(ii) (b) : The association or interactions of *Cuscuta* and hedge plant is parasitism, cactus and moth is predation and orchid and mango is commensalism.

(iii) (b)

(iv) (d) : Intraspecific competition is more severe because of common resource, similar needs and similar adaptations.

(v) (d)

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