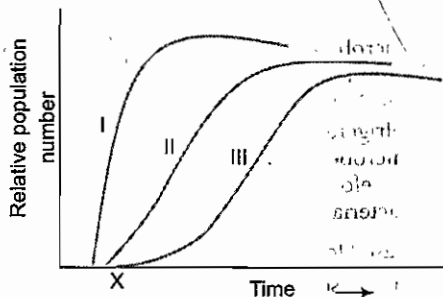


Let us Practice

Exercise I

1. Three lines (I, II and III) represent the relative population number of three different organisms where initially food is the only limiting factor to the carrying capacity (number of individuals). Which of the following best matches the three lines (I, II, III) with the organisms comprising each population given access to an unlimited food supply at time X?

I	II	III
(a) Elephant	Rabbit	Bacteria
(b) Mouse	Tiger	Cricket
(c) Bacteria	Rabbit	Elephant
(d) Lichen	Flowering plant	Moss



2. **Assertion** Biodiversity is worth preserving for ethical reasons rather than economic reasons.
Reason Only 2% of angiosperms are useful to man, in one way or another : in fact, not more than 20 have any value as major food 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 a correct explanation of Assertion
 (c) Assertion is true but Reason is false
 (d) Assertion is false but Reason is true
3. Green-house gases are
- (a) absorber of long wave radiation from earth
 (b) transparent to both solar radiation and long wave radiation from earth

- (c) absorber of solar radiations for warming the atmosphere
 (d) transparent to emission from earth for passage into outer space

4. Complete the following equation by putting one of the following options

For a population to maintain a constant size

- (a) Birth + Emigration = Death + Immigration
 (b) Death + Emigration = Birth + Immigration
 (c) Birth + Death = Emigration + Immigration
 (d) Birth + Emigration = Immigration + Death

5. The pyramid that cannot take the 'inverted' shape is

- (a) pyramid of numbers
 (b) pyramid of biomass
 (c) pyramid of energy
 (d) pyramid of parasitism

6. In terms of percentage of total forest cover, the most abundant type of the forest in India, is

- (a) tropical evergreen
 (b) tropical moist deciduous
 (c) tropical dry deciduous
 (d) tropical scrubs

7. Which of the following does not describe commensalism?

- (a) Epiphyte growing on a tree
 (b) Bird nesting on a tree
 (c) Small fish surviving on the excreta of the bigger fish
 (d) *E. coli* residing in the blood stream of human

8. Which of the following is least likely to be true of an ecological succession?

- (a) The species composition of the community changes continuously during the succession
 (b) The total number of species rises initially, then stabilizes
 (c) The total amount of non-living organic matter in the ecosystem increases
 (d) The total biomass in the ecosystem declines after the initial stages

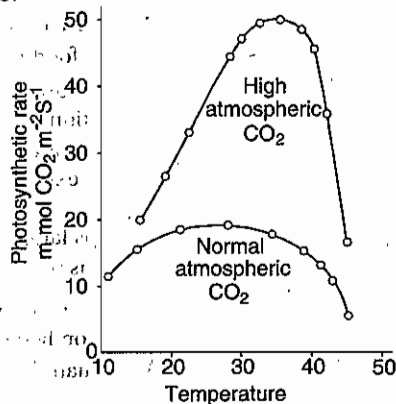
9. In a hypothetical developing nation, new government policies and international aid have resulted in improved family planning and decreased death rates. As a result, the average number of children per female, the average age of reproduction, and the average life expectancy are the same as in Canada. If we ignore changes in population size because of immigration and emigration, the population growth rate of the developing nation will now
- be the same as Canada's growth rate
 - decrease, attaining Canada's growth rate within 10 years
 - remain higher than Canada's because of climate
 - remain higher than Canada's because of economic differences between the developing nation and Canada
 - remain higher than Canada's until the population has reached a stable distribution of age classes

10. If we wish to manage a deer population, so that a very high number of deers can be harvested, we should manage the population so that
- the number of deers is far enough below the carrying capacity to support high birth and growth rates
 - the number of deers is at the carrying capacity to provide the largest sustainable deer population
 - the deers are rare and have little contact with each other
 - the number of deers slightly exceeds the carrying capacity, so that the excess can be harvested
 - the number of deers greatly exceeds the carrying capacity to provide a large number of excess individuals

11. Populations of many species of small mammals such as lemmings, voles, and snowshoe hares in Canada - undergo large population fluctuations on a predictable basis (e.g., every 3 to 4 years). Which of the following does not appear to play a role in these population cycles?
- Territorial (spacing) behaviour of adult members of these populations
 - Dispersal of individuals away from the area where they were born
 - Stress caused by the effects of living at high densities
 - High mortality caused by predators
 - Severe weather conditions

12. What will be the effect of green-house on the stomatal density in a particular species over the time?
- The stomatal density decreases
 - The stomatal density increases
 - There is no change in stomatal density
 - The stomatal density first increases and then decreases
13. Refrigeration at 4°C and cooking at 65°C or above is important for food storage and preparation. This is because
- refrigeration lyses the thin cell walls of pathogenic bacteria and, therefore, kills them while cooking ruptures eukaryote cell walls and thereby destroying any viruses that may infect humans
 - refrigeration preserves the activity of enzymes important for digestion of the cells of the food which are then released from the cells upon cooking
 - most prokaryote cells burst when refrigerated whilst most eukaryote cells are ruptured when cooked and, therefore, all cells entering the digestive tract are dead and are readily digested
 - refrigeration limits the reproduction of microbes whilst cooking releases antimicrobial compounds that kill pathogenic bacteria in the digestive tract
 - refrigeration limits the reproduction of microbes, whilst cooking kills microbes, and, therefore, the intake of live pathogenic bacteria within the food is limited

14. Increased levels of atmospheric CO₂ result in the 'green-house effect' and thus global climatic warming. The graph shows the effect of these changes on photosynthesis. Which of the following statements about these processes is false?



- (a) For most plants, temperatures over 40°C reduce photosynthesis
- (b) At temperatures below 20°C , high atmospheric CO_2 concentrations reduce photosynthesis to values below those seen for plants growing in normal CO_2 concentrations
- (c) One result of increased levels of atmospheric CO_2 will be to increase rates of photosynthesis in most plants
- (d) At high CO_2 concentration, the highest rates of photosynthesis are measured at temperatures between 30° and 35°C
- (e) CO_2 concentration is normally rate-limiting for photosynthesis
15. Which of the following statements are correct?
- I. Tropical rainforests are inhabited by evergreen trees.
- II. Seasonal periodicity is best seen in a deciduous forest.
- III. The extra-ordinary biodiversity of a rainforest is reflected in the very visible multicoloured flowers borne by the different species of trees found in it.
- IV. The floor of a deciduous forest in summer is covered by soft mat of humus.
- (a) I and IV (b) I and III
(c) I and II (d) III and IV
16. Which one of the following statements is correct?
- (a) Upto about 15 km above the earth's surface, ozone is beneficial to life but chlorofluorocarbons are harmful
- (b) Beyond about 20 km above the earth's surface, presence of ozone is vital to life on earth and chlorofluorocarbons are beneficial
- (c) Beyond about 20 km above the surface of earth, ozone is vital to life on earth, but chlorofluorocarbons are harmful
- (d) Upto 15 km above the earth's surface both ozone and chlorofluorocarbons are harmful
17. A less supply of which of the following nutrients is the most common cause of eutrophication in freshwater lakes?
- (a) Phosphorus (b) Calcium
(c) Sulphur (d) Potassium
(e) Nitrogen
18. Because of interest in the global carbon (C) cycle and the green-house effect, ecologists are estimating, how much C is in each biome and whether the sizes of these C pools are changing.

The organic matter (humus and dead plant tissues) in the soils of the boreal forest biome forms one of the largest pools of C in the biosphere. On average, boreal forest soils contain $15,000 \text{ g C m}^{-2}$, a higher value than occurs in other types of forest. However, the primary production of the boreal forest is only $350 \text{ g C m}^{-2} \text{ yr}^{-1}$ on average, a low value compared to other types of forests. This pattern occurs primarily because

- (a) high rates of herbivory in the boreal forest lead to low levels of forest productivity
- (b) the slow weathering of bedrock under boreal forest soils releases large quantities of C into the soil. This C would be lost in hotter climates
- (c) low rates of herbivory in the boreal forest mean that most leaves, branches, and roots are added to the soil when they die. Temperate and tropical forests, in contrast, have high rates of herbivory
- (d) the cold, wet soils of the boreal forest restrict decomposition more than they restrict the photosynthesis of plants
- (e) periodic fires destroy large areas of boreal forest and keep primary productivity low, while leaving most of the soil C intact
19. Which one of the following chemicals is not related to biological magnification?
- (a) Chlorinated hydrocarbon
(b) Heavy metal
(c) Organophosphates
(d) Polychlorinated biphenyls
20. The traditional concept of succession includes the idea of an equilibrium state called a climax community. Ecologists now think there may be no such thing as a climax community because
- (a) disturbance is ongoing in ecosystems
(b) all organisms eventually die
(c) species diversity generally increases
(d) each succession is different from others
21. Which one of the following sets consists entirely of endangered wild life species of India?
- (a) Himalayan musk deer, black buck, Indian lion, rhino, sambar
- (b) Himalayan musk deer, Indian lion, rhino, wild buffalo, golden cat
- (c) Egret, black boar, bison, spotted deer
- (d) Himalayan musk deer, great Indian bustard, snow leopard, Kashmir stag, wild ass

22. A biological clock measures the length of each night by the
- rate at which one kind of phytochrome is converted to the other
 - ve amounts of red absorbing and far red absorbing phytochrome at dawn
 - nts of far red absorbing phytochrome at dusk
 - relative amounts of red absorbing and far red absorbing phytochrome at midday

23. Domesticated crop plants rarely become aggressive weeds. This is because
- they are not grown in habitats favourable for rapid colonization
 - their high seed production is not adaptive for an invading species
 - they possess traits with low survival value in the wild
 - they are genetically uniform

24. Which of the following ecological relationships between pairs of organisms is different from the other pairs?
- Fish – Algae
 - Leaf rust (fungus) – Wheat
 - Cow – Grass
 - Giraffe – Shrub

25. In a stable ecosystem, which of the following limits the number of trophic levels?
- Biomass
 - The number of nutrients
 - Availability of nutrients
 - Presence of contaminants that increase in concentration along the food chain

26. The carnivorous plants trap and digest insects. By trapping insects, they obtain
- Water to survive in dry soil.
 - Phosphorus for nucleic acid synthesis.
 - Phosphorus for protein synthesis.
 - Sugars to supplement those produced by photosynthesis.
 - Nitrogen for protein synthesis.
- The correct statement (s) is /are (2nd INBO)

- III and IV
- II and V
- I and II
- I, II and IV

27. The water runoff from an area under study showed a very high concentration of nitrate ions. This is an indication of (4th NSEB)
- very heavy rainfall
 - drought
 - total cut down of trees
 - excessive growth of trees

28. What would be most likely to happen, if decomposers (bacteria and fungi) went extinct on Earth?

- Detritivores (such as earthworms) would replace them
- Primary productivity would increase
- Nutrients would accumulate in dead plants and animals and become unavailable to living organisms
- Carnivores and herbivores would not be affected
- Food webs would lose one trophic level

29. Which of the following adaptations are found primarily in animals living in arid (dry) conditions?

- Short loops of Henle in the kidney
- A compound eye
- An exoskeleton
- Excretion of nitrogenous wastes as uric acid
- Countercurrent gas exchange system in the lungs

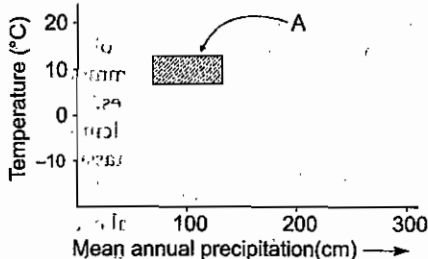
30. Pyramid of numbers is inverted in the case of (3rd NSEB)

- pond ecosystem
- one tree ecosystem
- forest ecosystem
- Both (b) and (c)

31. Which nutrient is most likely to limit primary production in terrestrial ecosystems?

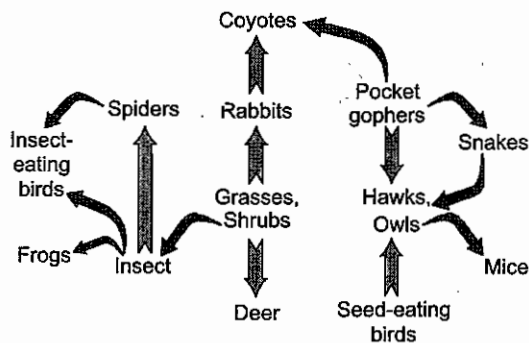
- Carbon
- Sulphur
- Phosphorus
- Nitrogen
- Potassium

32. Given graph depicts optimum temperature and moisture of different biomes. Biome A in the graph is (2nd NSEB)



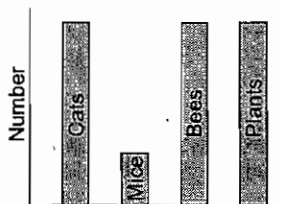
- tropical rainforest
- coniferous forest
- temperate forest
- tundra

33. The carrying capacity of a population means
- the rate at which the density of individuals increase over-time
 - the maximum number of individuals which can be supported in a given environment
 - the proportion of individuals which are most responsible for population growth
 - the minimum number of individuals necessary to avoid extinction of the population
34. An area of bushland was cleared in anticipation of a new road being constructed. The road was not constructed and the land was left to overgrow. The process by which the vegetation re-established is called
- primary succession
 - secondary succession
 - tertiary succession
 - regenerative succession
35. Study the following diagram and answer the question which follows :

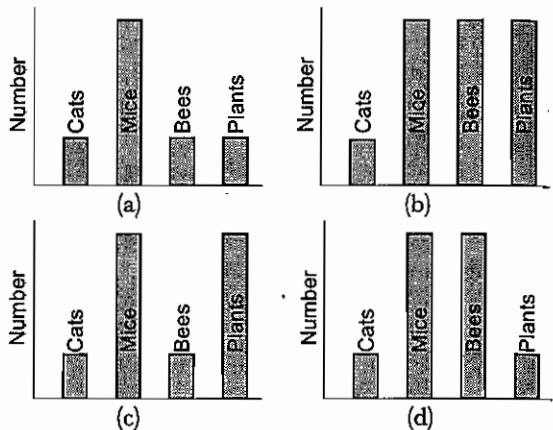


The total energy of all the organisms in each group would be the greatest for the

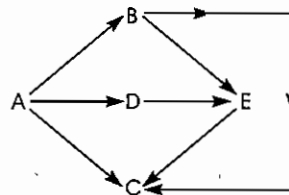
- mice
 - rabbits
 - grass
 - decomposers
36. In an ecosystem, four major interdependent components were in the given proportions



What would be the new composition of the same ecosystem when majority of the cats were killed? (4th NSEB)

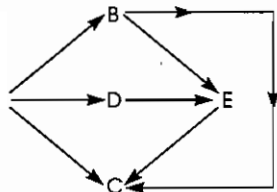


37. Shown aside is a diagram of food web of a given terrestrial ecosystem. The arrows represent energy flow and the letters represent different species. In which species would a toxic pollutant that accumulates in animals probably reach the highest concentration?



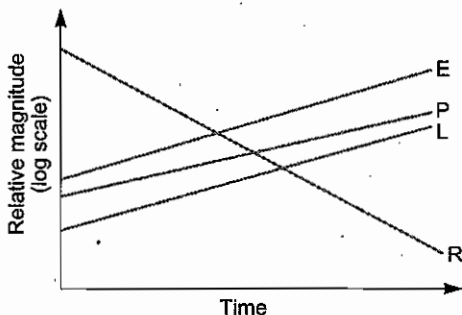
- Species D
 - Species B
 - Species C
 - Species E
38. What is the most likely explanation for the observation that two individuals originating from the same clone look different?
- They developed in different environments
 - They are differentially adapted to the same environment
 - The clone from which they originated had more than one genotype
 - They differ in heterozygosity
 - They differ in homozygosity
39. The major primary producers of an ecosystem are plants while other contributors are
- cyanobacteria (2nd INBO)
 - chemosynthetic bacteria
 - heterotrophic bacteria
 - Both (a) and (b)

To questions 40, 41 and 42, please use the given diagram of a food web of a given terrestrial ecosystem. The arrows represent energy flow and the letters represent different species.



40. Which species is most likely the decomposer?
 (a) Species A (b) Species B
 (c) Species C (d) Species D
 (e) Species E
41. If species D is distasteful to predators, which species is most likely to benefit from being a mimic of species D?
 (a) Species A (b) Species B
 (c) Species C (d) Species D
 (e) Species E
42. In which species would a toxic pollutant that accumulates in animals probably reach the highest concentration?
 (a) Species A (b) Species B
 (c) Species C (d) Species D
 (e) Species E
43. In a stable terrestrial (land based) food chain, which of the following statements is correct?
 (a) The total mass of the primary producers will be less than the mass of any other trophic level
 (b) Tertiary consumers consume secondary consumers, which in turn consume primary consumers
 (c) At any given time, the biomass of decomposers is directly proportional to the biomass of primary producers
 (d) All tertiary consumers are mammals
 (e) Decomposers do not exist
44. Energy pyramids of an ecosystem tend to diminish at higher trophic levels. This is because at each successive level
 (a) the organisms become smaller
 (b) energy is stored and, therefore, less is passed on to the next level
 (c) energy is being concentrated in fewer and large organisms
 (d) energy is being lost from one level to the next

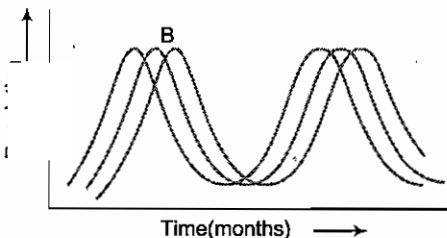
45. Halophytes such as mangrooves meet high osmotic pressures in the soil. They overcome the problem of water uptake by (2nd INBO)
 (a) increase in the root to shoot ratio
 (b) reduction in the number of stomata to reduce transpiration
 (c) accumulation of electrolytes in the vacuoles
 (d) growth at relatively high humidities to reduce transpiration
46. The accompanying graph depicts the relationship between environmental impact (E), world population (P), average standard of living (L) and world resources (R). What is expected, if the world population remains stable but the average standard of living continues to increase? (3rd NSEB)



- (a) Environmental impact will increase without much change in resources
 (b) Environmental impact will not change but resources will deplete
 (c) Environmental impact will increase and resources will deplete
 (d) Environmental impact and state of resources may not show significant change
47. Major pH changes are observed during day and night in ponds and lakes containing lots of submerged aquatic flora and fauna. The nature of these changes would be
 (a) increase of pH during day and decrease of pH during night
 (b) decrease of pH during day and increase of pH during night
 (c) increase of pH during the day and negligible change during night
 (d) Both (a) and (c) are correct

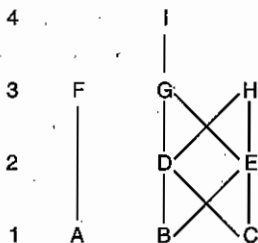
48. The most important factor regulating seasonal migration is
 (a) the change in average air temperature
 (b) the change in day length
 (c) the reduced availability of food
 (d) the increased predator pressure
49. Ecology is the study of relationship of living organisms with one another and with their surroundings. Which one of the following is not true for any ecosystem? (1st NSEB)
 (a) Ecosystem mainly focuses on flow of energy and cycling of matter
 (b) Biotic component is more important than abiotic component
 (c) Autotrophs produce the material and energy for heterotrophs
 (d) None of the above
50. The sea star *Pisaster ochraceus* is an abundant predator on the rocky intertidal communities along the Pacific coast of North America. The sea star feeds predominately on the mussel *Mytilus californianus*. In the absence of the sea star, the mussel is a dominant competitor, crowding out other species. Based on these observations, which statement relating to the number of species in the intertidal zone is most likely to be correct?
 (a) The number of species should be unaffected by the presence or absence of the sea star
 (b) The number of species present will be changed by the presence of the sea star, but the direction (*i.e.*, more or less species) cannot be predicted
 (c) The number of species present should be greater when the sea star is present than when it is absent
 (d) The number of species present should be less when the sea star is present than when it is absent
 (e) The mussel will go extinct in the intertidal zone when the sea star is present
51. Carbon dioxide is called a green-house gas because it is
 (a) used in green houses to increase plant growth rates
 (b) transparent to heat (infra red or IR) radiation but opaque to sunlight
 (c) transparent to sunlight but opaque to heat radiation
 (d) transparent to both sunlight and heat radiation
52. Ecologically speaking, standing crop means
 (a) totality of all trophic levels, both animals and plants, comprising it
 (b) the trophic level made up of primary producers only, *i.e.*, green plants only
 (c) the trophic level made up of primary consumers only
 (d) the trophic levels of consumers of all orders
53. The total biomass in a terrestrial ecosystem will be greatest for which trophic level?
 (a) Herbivores
 (b) Producers
 (c) Primary consumers
 (d) Tertiary consumers
 (e) Secondary consumers
54. An algae is often seen growing on the shell of a turtle. This type of relationship is called
 (a) mutualism (1st NSEB)
 (b) commensalism
 (c) parasitism
 (d) predation
55. The concentration of polychlorinated biphenyls (PCB, an organochloride contaminant) in many fish populations has been declining, since a ban on their production was instituted in the late 1970s. PCBs remain a potential problem, however, because they are lipophilic and are known to biomagnify. Based on this knowledge, what type of fish is expected to be safest for human consumption (*i.e.*, with the lowest concentration of organochlorides)?
 (a) Slow-growing fish species
 (b) Piscivorous fish species (*i.e.*, which eat other fish)
 (c) Benthivorous fish species (*i.e.*, which eat invertebrates on the lake bottom)
 (d) Small (young) fish
 (e) Fish species with high fat content
56. As the number of individuals approaches the carrying capacity of a population, which of the following is predicted by the sigmoidal growth curve?
 (a) Population density will increase exponentially
 (b) Population density will decrease exponentially
 (c) Population growth rate will increase
 (d) Population growth rate will decrease
 (e) Population biomass will remain the same

57. Different trophic levels in an ecosystem are depicted below. Line B in the graph represents (2nd NSEB)

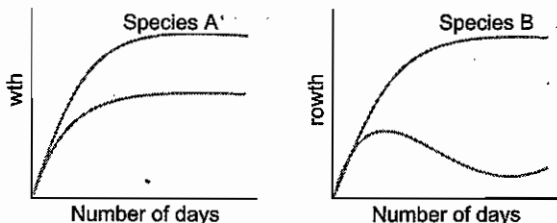


- (a) primary producer (b) primary consumer
(c) secondary consumer (d) tertiary consumer
58. Terrestrial adaptations of different plant structures are complemented by chemical adaptations. Mark the incorrect option.
(a) Cardiac glycosides (b) Sporopollenins
(c) Lignin (d) Chlorophyll
59. The diagram below, shows the feeding interactions between nine species (A to I) of a food web with four trophic levels. Which statement about this food web is correct?

Trophic level



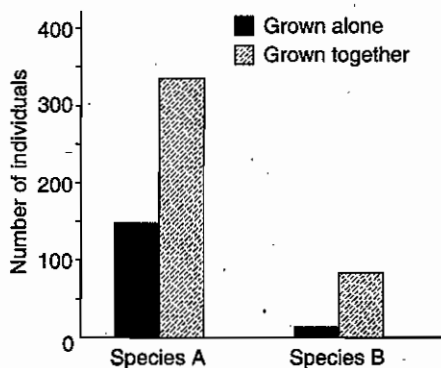
- (a) Species A is a herbivore
(b) Species D is a carnivore
(c) Species G is an omnivore
(d) Species H is a predator
(e) Species I is a primary producer
60. The graphs given below show the growth of two species A and B, when grown separately—and together (...). The graph indicates (4th NSEB)



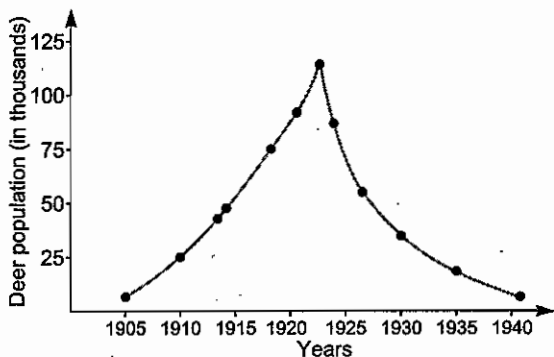
- (a) competition
(b) synergism
(c) parasitism
(d) commensalism

61. The growth speed of a population can often be described with the logistic growth equation : $dN / dt = rN(K - N) / K$
In this equation, N is the number of individuals, r is the intrinsic relative rate, and K is the carrying capacity. According to this equation, the equilibrium number of individuals in the population is determined by
(a) r only (b) K only
(c) r and K (d) N and K
(e) r and N
62. Which of the following is true for biogeographic regions?
(a) Each represents a different climatic region
(b) They are influenced mainly by relatively recent events
(c) Different biogeographic regions do not contain any of the same biomes
(d) They are mainly the result of movement of land masses
63. You are studying two populations of a species of aquatic insect in two different ponds. Both populations go through several generations each summer. The per capita food supply is the same in both pools throughout the year and it is evenly distributed throughout the water column. You find that the population in pond A is increasing in numbers at a faster rate than the population in pond B. Which observation is most likely not contributing to this pattern?
(a) Individuals in pond A have more offspring than individuals in pond B
(b) Individuals in pond A have smaller offspring than individuals in pond B
(c) Individuals in pond A mature at a younger age than individuals in pond B
(d) There is a predator that rarely preys on this species but it is enough of a threat that it scares this species of insect into hiding in the vegetation at the very edge of the pond; this predator only lives in pond B
(e) Individuals in pond B have shorter life spans than individuals in pond A

64. Two insect species were used in a laboratory experiment. For one treatment, both species were grown by themselves (in separate chambers) on a suitable food source. For the second treatment, the two species were grown together (in the same chamber) on the same type and amount of food as in the first treatment. The given figure shows the results (the number of individuals of each species in the two treatments) at the end of the experiment. Based on these results the two species should be classified as

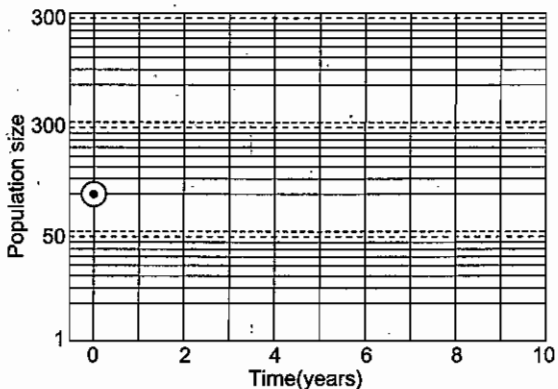
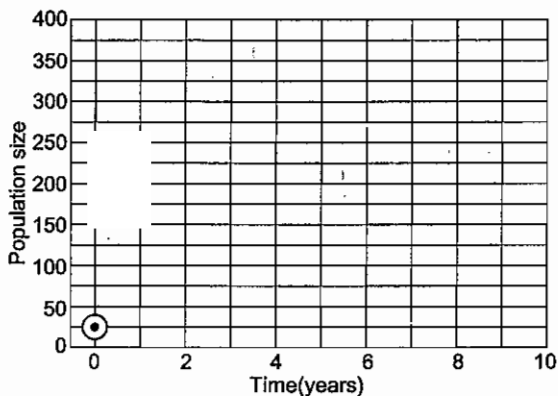


- (a) competitors
 (b) antagonists
 (c) mutualists
 (d) predators or pathogens
 (e) commensalists
65. Symbiotic relationships are important to plants. Such relationships are found
- (a) only with dicotyledon plants, including legume and non-legume plants
 (b) in grass plants growing in areas of low soil fertility
 n legume plants only
 n most species of plants
66. In an ecosystem, the deer population was stagnant. Measures, such as killing the wolves, were taken to increase deer population. The graph depicts the population of deers after human intervention. Mark the correct statement.



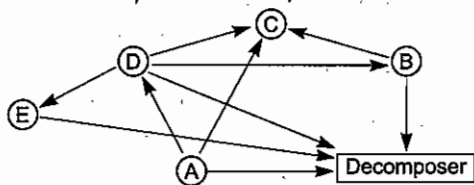
- (a) Measures have proved useful in the long run
 (b) Sharp fall in deer population is due to some calamity
 (c) The deer and wolf population are in equilibrium
 (d) Predation is beneficial to the prey for a stable ecosystem
67. In the event of global warming, which one of the following is most likely to occur?
- (a) Existing plant and animal communities will move North in response to warming
 (b) Agriculture in the Prairie provinces will be redeveloped on soils of the Canadian Shield
 (c) The anticipated rise in sea level will be caused primarily by the melting of polar ice caps
 (d) The decomposition of organic matter in the unfrozen surface layer of polar soils will increase
 (e) tundra vegetation will increase in area as soils dry out in polar regions
68. We have introduced an animal species to an island, where it undergoes exponential growth in this new unexploited, resource-rich environment. The initial population size (year 0) is 20 individuals (point shown on graphs). After 4 years, the population size is 80 individuals. What is the population size after 10 years, assuming that exponential growth has continued?

Ecology and Environment



- (a) The population will be at its carrying capacity, but too little information about the biology of the species is given to determine what that value is
- (b) About 140 individuals
- (c) About 170 individuals
- (d) About 400 individuals
- (e) About 640 individuals

69. The given figure represents a food web in particular ecosystem. Each letter represents a species. The arrows indicate the direction of energy flow. Which would most likely represent humans if they were part of this ecosystem?



- (a) D (b) B
(c) C (d) None of these

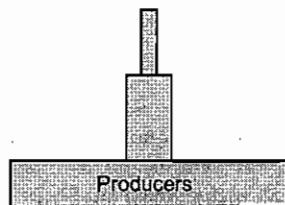
70. Which of the following sets of values would result in a population with a growth rate of zero?

- (b = births, d = deaths, i = immigration, e = emigration)
- (a) b = 1000, d = 500, i = 750, e = 1000
- (b) b = 1000, d = 500, i = 1000, e = 1000
- (c) b = 1000, d = 500, i = 1500, e = 1000
- (d) b = 1000, d = 500, i = 0, e = 1000
- (e) b = 1000, d = 500, i = 500, e = 1000

71. Commensalism is an interaction between two organisms where

- (a) one organism benefits without affecting the other
- (b) both organisms benefit by the relationship
- (c) one organism benefits at the expense of the other
- (d) neither organism benefits from the relationship

72. The pyramid of biomass given below represents



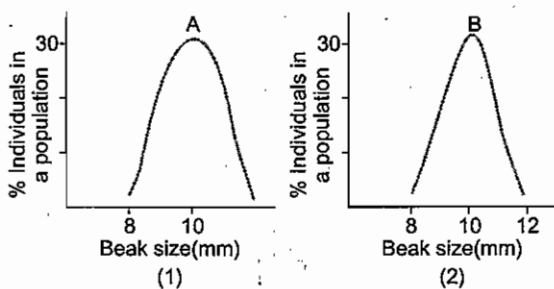
- (a) a forest
- (b) a grassland
- (c) an ocean
- (d) a mammal with parasites
73. The sequence of blue-green algae → crustose lichens → foliose lichens → mosses → shrubs → dicot trees represents
- (a) genetic mutation
- (b) ecological succession
- (c) food pyramids
- (d) evolutionary trend
74. The pollutants which are already present in nature, but are released in substantial amounts by man, are known as
- (a) qualitative pollutants
- (b) degradable pollutants
- (c) primary pollutants
- (d) quantitative pollutants

75. Natural sink of stratospheric ozone is
 (a) sulphur dioxide
 (b) sulphur fluxes of oceans
 (c) freons
 (d) HCFCs
76. A swamp that has many aquatic plants growing in it is suddenly polluted. As a result of the pollution, all of the plants die. Shortly after the

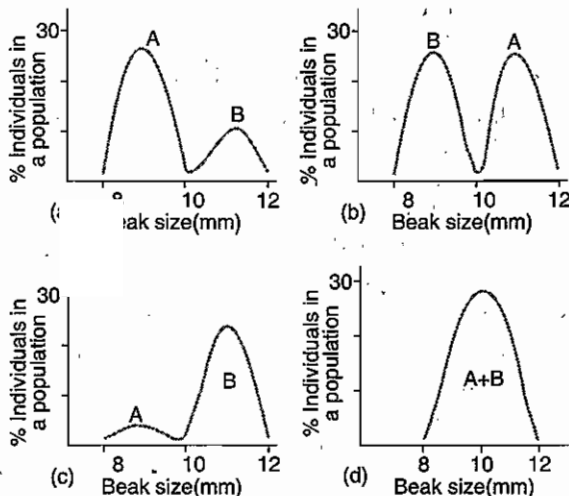
- pollution, which of the following would decrease in concentration in the water of the pond?
 (a) Oxygen
 (b) Carbon dioxide
 (c) Nitrogen in the form of nitrate and ammonium
 (d) Phosphate
 (e) Zinc and copper

Exercise II

1. Two bird populations (A and B) on two islands were examined for their beak sizes. The results are shown in graph 1 and 2 respectively.



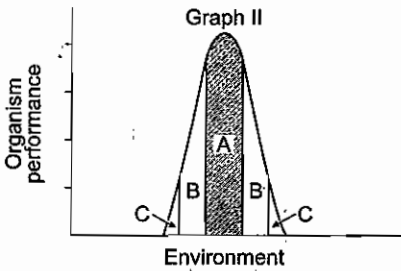
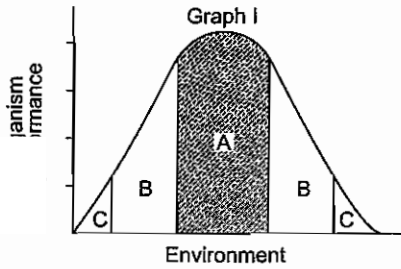
When these two populations were brought together on one island competition for the ecological niche between birds with identical beaks greatly increased and they were reduced in number. This situation is correctly depicted in (2nd INBO)



2. Ecological assemblies K through Q consist of species designated with numbers 1 through 8, present at various densities. Individual densities of these species in any particular assembly are given (as individuals per square meter) in the table. Which of the above assemblies is the least susceptible to a massive pest infection (gradation)?

Assembly	K	L	M	N	P	Q
Species 1	50	92	75	0	0	0
Species 2	30	4	5	25	2	65
Species 3	10	0	5	20	3	20
Species 4	10	0	5	20	5	10
Species 5	0	1	5	20	40	3
Species 6	0	1	5	5	50	2
Species 7	0	1	0	0	0	0
Species 8	0	1	0	0	0	0

- (a) K
 (b) M
 (c) N
 (d) Q
3. In the human-induced process called acid precipitation, the main biogeochemical cycles that are altered are the cycles and one effect in lakes is to populations of nitrifying bacteria.
 (a) phosphorus and nitrogen, increase
 (b) phosphorus and nitrogen, decrease
 (c) nitrogen and sulphur, decrease
 (d) nitrogen and sulphur, increase
 (e) phosphorus and sulphur, decrease
4. Performance of an organism with respect to the environmental conditions is shown below in graph I and II.



A : Reproduction, A + B : Growth and A + B + C : Survival

Compare the two graphs (Assume that both the graphs have identical X and Y axes).

Mark the correct interpretation.

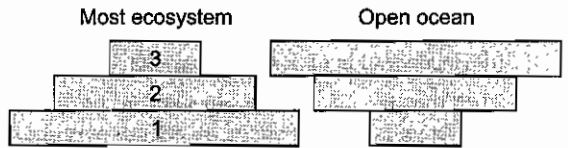
- (a) Species shown in graph II is more evolved and more specialized in function than that shown in graph I
- (b) Species shown in graph II has higher survivorship but less reproductive success
- (c) Both species have identical feeding niche
- (d) If both the species coexist, there are greater chances of graph I being eliminated due to severe competition

5. In most ecosystems, the biomass of a trophic level is higher than the biomass of its predators, as illustrated below by an upright pyramid of biomass. In the open ocean, however, the biomass of primary producers (microscopic algae) is often lower than the biomass of higher trophic levels (for example, zooplankton and fish), as illustrated below by an inverted pyramid of biomass. In the open ocean, how can there be enough food to support the higher trophic levels?

Note The width of the bars indicates the amount of biomass at each trophic level.

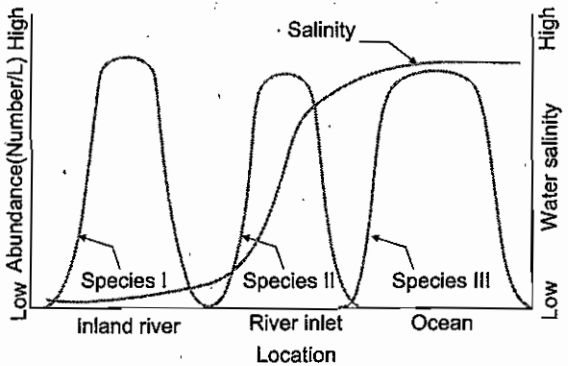
- (a) The microscopic primary producers are a source of food of high quality
- (b) The microscopic primary producers have high rates of growth and reproduction

- (c) The microscopic primary producers are very abundant
- (d) The higher trophic levels are cold-blooded animals which do not require much food
- (e) The higher trophic levels are efficient predators



Question 6 & 7 relate to the following information :

In the graph below, the population density is given for three different, but similar, species of algae found in a river. River inlet to the ocean and the ocean.



- 6. Which algae exists in the greatest density?
 - (a) Species I
 - (b) Species II
 - (c) Species III
 - (d) Both species I and III have the greatest density
 - (e) It is not possible to answer with the data supplied
- 7. Which algae is able to grow over the widest salinity range?
 - (a) Species I
 - (b) Species II
 - (c) Species III
 - (d) Both species I and III have the widest salinity range
 - (e) It is not possible to answer with the data supplied

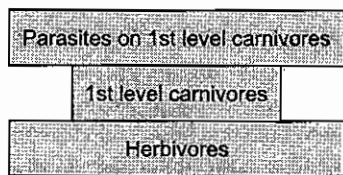
8. When a new male, takes over a lion pride, they sometimes kill or evict the cubs already present. This phenomena can be explained from behavioural ecology

- (a) the male doesn't like cubs
- (b) the male cannot afford too much for caring for those cubs
- (c) the male breed his own offspring
- (d) degeneration of the males parental behaviour

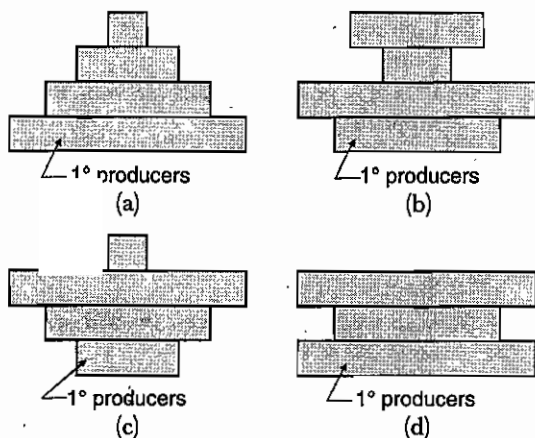
9. The transfer of energy through a terrestrial ecosystem is often depicted by energy pyramids. Which of the following statements is true?

- (a) Ecological efficiency is highest for top consumers
- (b) About 10% of the energy from one trophic level is incorporated into biomass of the next level
- (c) The energy lost as heat or in cellular respiration is 10% of the available energy of each trophic level
- (d) Only 25% of the energy in one trophic level is passed onto the next level

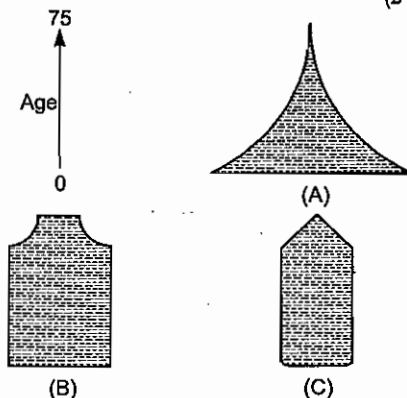
10. Pyramid shown below is a typical number pyramid in which producers have been omitted. (2nd INBO)



If the above pyramid is converted into a biomass pyramid, it will take the shape of

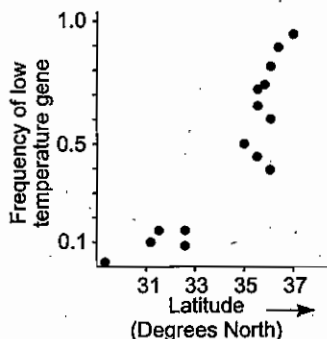


11. Age structure diagrams (A, B, C) for three populations are shown below. They represent (2nd INBO)



- (a) A-Declining population
B-Stable population
C-Growing population
- (b) A-Growing population
B-Stationary population
C-Declining population
- (c) A-Exponential growth
B-Indeterminate growth
C-Stationary population
- (d) A-Growing population
B-and C-stable population

12. Frequency of the 'low temperature gene' coding for esterase enzyme in a species of fish is shown below. It indicates (2nd INBO)



- (a) adaptation
- (b) homeostasis
- (c) tolerance
- (d) intraspecific competition

13. An ecosystem comprises of an oak tree under which a corns germinate and begin to grow. Only some of these survive and grow. This can be correctly described as (2nd INBO)

- (a) intraspecific competition only for water
- (b) interspecific competition for light and food
- (c) intraspecific competition for energy, matter and space
- (d) inter as well as intraspecific competition for space

14. two different species associate with each other for the benefit of both, it is termed as mutualism. Which of the following is not a positive interaction? (2nd INBO)

- (a) Flower and nectarivore
- (b) Plant and herbivore
- (c) Leguminous plant and nitrogen fixing bacterium
- (d) A lichen

15. The most useful policy for 'pest resistance management' among the following is (2nd INBO)

- (a) use of pesticide that kills greater number of target pests along with their natural enemies
- (b) repeated application of single pesticide with a broader coverage of land
- (c) selecting a concentration of a pesticide that is just sufficient to kill pests which are homozygous for resistant genes
- (d) using a combination of pesticides with a reduced frequency of application

16. The pH of unpolluted rain is around 5.6 while that of acid rain is around 4.2. The pollutant/s responsible for this acid rain is/are

- I. Sulphur dioxide
- II. Nitrogen oxide
- III. Carbon dioxide
- IV. Lead oxide

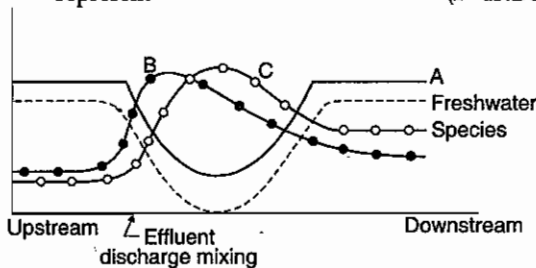
- (a) I and II
- (b) I, II and III
- (c) I and IV
- (d) I and III

17. Mark the incorrect option regarding 'freshwater biomes'.

- (a) Profundal zone—open, photic waters—with photosynthetic life forms
- (b) Littoral zone—shallow well lit waters—rooted and floating aquatic plants
- (c) Limnetic zone—well lit, open, farther from shore—variety of phytoplankton of algae and cyanobacteria
- (d) Benthic zone—deep, aphotic zone—rich aerobic microbial life decomposing detritus

18. The graph represents changes in different ecological parameters due to effluent mixing in a

stream. The three lines A, B and graph C represent (2nd INBO)

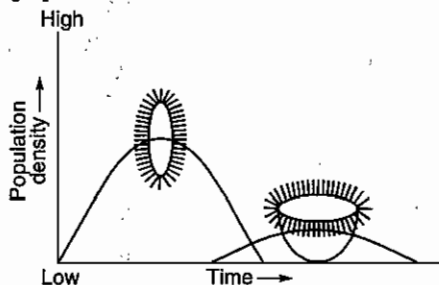


- (a) A—Oxygen concentration
B—Biological O₂ demand
C—Pollution resistant species
- (b) A—Pollutant
B—Aerobic process
C—Anaerobic process
- (c) A—Oxygen concentration
B—CO₂ concentration
C—Temperature
- (d) A—Phosphate concentration
B—Nitrate concentration
C—Rate of photosynthesis

19. Nitrogen is fixed in ecosystems in ways stated below. Which one of the statements below is false?

- (a) By cyanobacteria
- (b) By electrical discharges in the atmosphere
- (c) By industrially synthesized fertilizer
- (d) By atmospheric deposition
- (e) By denitrification

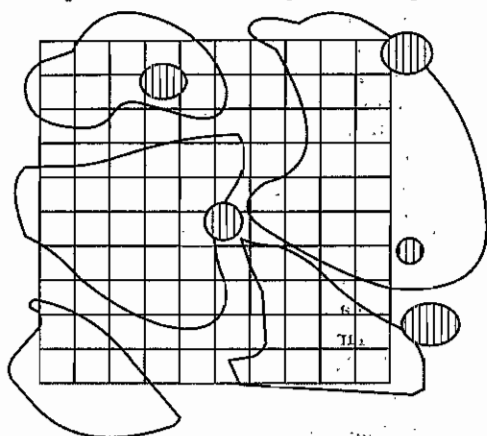
20. Shift in population density of different species is brought about by several phenomena. Which one of the following is depicted by the given graph?



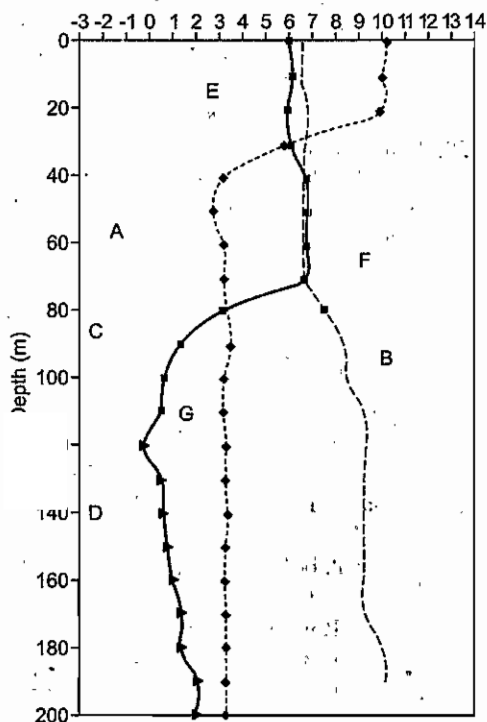
- (a) Parasitism
- (b) Extreme predation
- (c) Symbiosis
- (d) Commensalism

21. The diagram shows a 10 m × 10 m plot located in a forest with two main tree species : Species X which is shaded grey, and species Y which is shaded black.

The plot is divided into a grid with step 1 m.



- A. What are the percentage frequencies of Species X and Y using a quadrat size of 2 m × 2 m?
- B. What are the percentage frequencies of Species X and Y using a quadrat size of 5 m × 5 m?
22. The Baltic Sea is brackish, receiving salt water from the North Sea, and fresh water from rivers. Turnover of water in deep layers is much slower than at surface layers.



Stratification of the water column is common in summer. The following figure shows a depth profile (in July), for oxygen concentration (mg/L), hydrogen sulphide concentration (mg/L), salinity (PSU) and temperature (°C) in the water column.

Match in the table the labels A, B, C and D with oxygen concentration, hydrogen sulphide concentration, salinity and temperature, and the labels E, F and G with parts of the curves—halocline, redoxcline and thermocline.

1.	Oxygen concentration
2.	Hydrogen sulphide concentration
3.	Salinity
4.	Temperature
5.	Halocline
6.	Redoxcline
7.	Thermocline

23. Most birds start to incubate when their clutch is full. There are species which start incubation after the first egg is laid. Their chicks hatch asynchronously, which is characteristic to birds of prey and owls (Falconiformes, Strigiformes). Mark all the correct statements in the table.

A.	Food resources for birds of prey and therefore the number of chicks they can feed differ between years significantly
B.	Younger nestlings are fed more often and they catch up with older ones in the progress of their growth
C.	Birds of prey feed as many chicks of the brood as the food resources allow in the given year
D.	During years with scarce food resources, food is given mainly to the oldest nestlings, while the youngest ones starve to death
E.	Older nestlings help to feed younger ones
F.	Room in the nest is not sufficient for several big chicks simultaneously, therefore they grow up and fly out of the nest one at a time
G.	One fledgling that can reach reproduction age is more important for species survival than several but not well developed fledglings
H.	The number of fledglings and not their fitness is the most important for the species survival

24. In ecological pyramids, normally each higher trophic level is smaller. Possible exceptions leading to inverted pyramids are
- I. A pyramid of numbers with one big producer.

II. A pyramid of mass when producers have a very short life cycle.

III. A pyramid of energy in extremely hot stems.

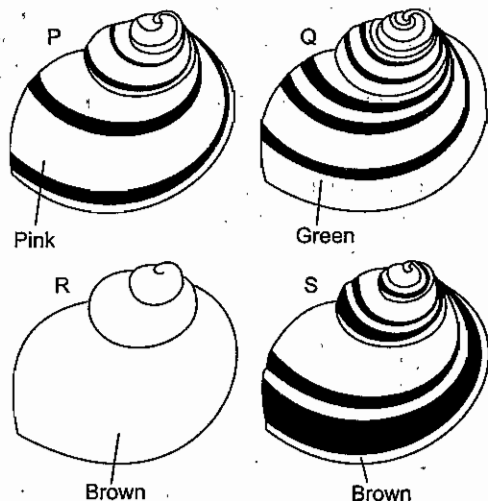
Which combination is correct?

- (a) II (b) II and III
 (c) I and III (d) I, II and III
 (e) None of these

25. The shell of the land snail shows variation in both colour and banding pattern. In order to construct a 5-figure banding formula, bands are numbered from the top of the largest whorl, as shown in the diagram. '0' is used to represent the absence of a band and square brackets indicate the fusion of two bands.



(Banding formula = 1 2 3 4 5)



(i) Using the appropriate letter, indicate the banding formula of shell S.

- (A) 030[45]
 (B) 03045
 (C) 02045
 (D) 003[45]

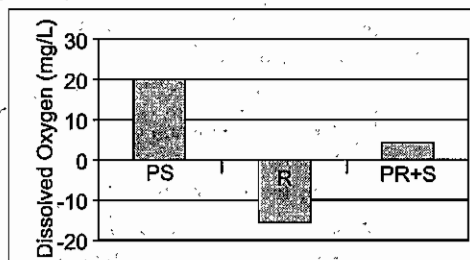
(ii) Thrushes (which have good colour vision) smash the shells of land snails against stones (anvils) in order to feed on the soft inner body. If snail types P, Q, R and S began in equal number in a habitat of grassland, which would be the most popular among birds?

- (A) P
 (B) Q
 (C) R
 (D) S

(iii) A survey of broken shells collected from thrush anvils amongst dead beech leaves in a woodland area was carried out. Predict which of the following sets of results was obtained?

Options	Broken shells of each type (%)			
	P	Q	R	S
(a)	13	33	1	5
(b)	11	1	34	6
(c)	5	1	14	32
(d)	6	21	20	5

26. The graph shows the productivity of an aquatic ecosystem measured in terms of dissolved oxygen produced and consumed by green plants and photosynthetic algae where PS = photosynthesis and R = respiration.

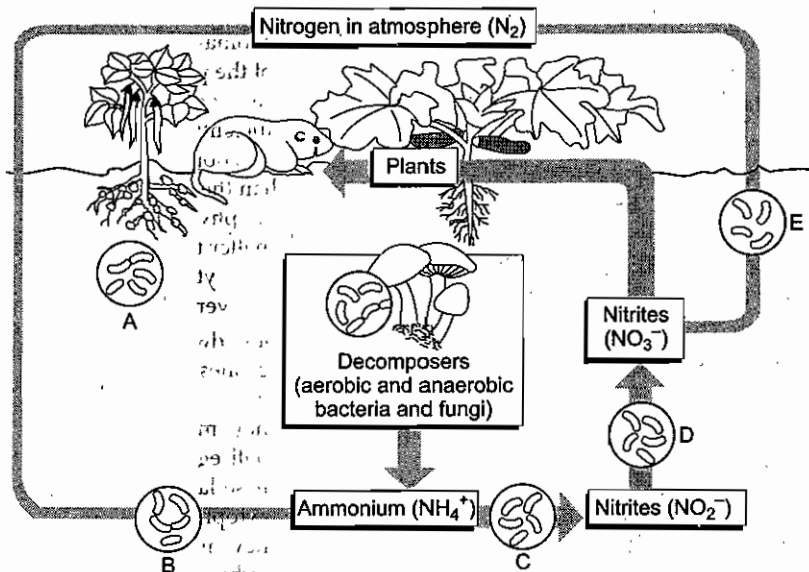


Study the graph and answer the following questions.

- (i) Which bar represents net primary productivity?
- (ii) An algal bloom occurs until nutrient levels are exhausted. Then the algae die off and microbial decomposition begins. What will happen during the algal bloom?
- PS will be increased, R will be decreased.
 - PS will be decreased, R will be increased.
 - PS and R will not change.
 - PS + R will increase.
 - PS + R will decrease.
 - PS + R will remain unchanged.

27. The figure below shows the nitrogen cycle.

Complete the table below according to the information provided.



Bacteria	Answer : (A through E *)
(a) Able to form nodules with plants	-
(b) Able to denitrify	-
(c) Able to nitrify	-
(d) Able to use ammonium as energy source	-
(e) Able to fix nitrogen from air	-

*Note : There could be more than one correct answer.

28. If N represents population size, r represents the difference in per capita birth rates and death rates, K represents the carrying capacity, t represents time, which of the following equations describes logarithmic growth of the population?

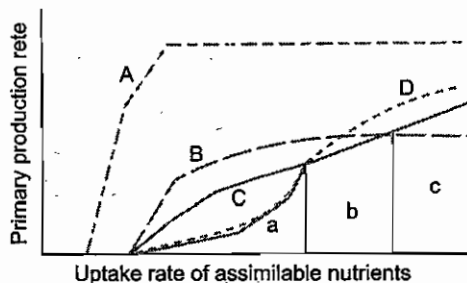
- (a) $\frac{dN}{dt} = rN$
 (b) $\frac{dN}{dt} = rNK$
 (c) $\frac{dN}{dt} = r(K - N)$
 (d) $\frac{dN}{dt} = rN \left(\frac{K - N}{K} \right)$

29. The graph represents the hypothetical results of an experiment designed to recognize which nutrients can act as limitants of productivity in a salinized water lake. According to the areas of limitation, determine the lines in the graphic which correspond to each of these nutrients : phosphorus, nitrogen, iron and copper.

References

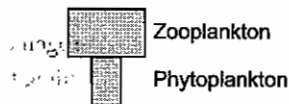
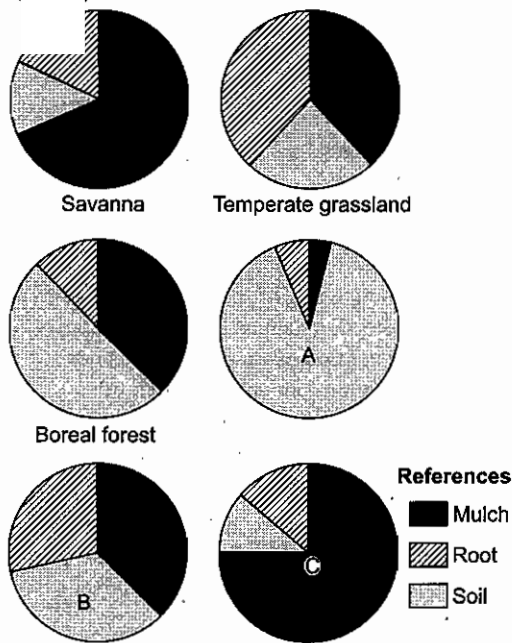
Solid black line : Primary production

- (i) Iron limitation area
 (ii) Nitrogen limitation area
 (iii) Phosphorus limitation area



	A	B	C	D
(a)	Iron	Nitrogen	Phosphorus	Copper
(b)	Copper	Phosphorus	Nitrogen	Iron
(c)	Nitrogen	Phosphorus	Iron	Copper
(d)	Copper	Nitrogen	Iron	Phosphorus
(e)	Iron	Copper	Phosphorus	Nitrogen

30. Organic matter decomposition depends in part on climatic factors such as temperature and precipitation. In the following schemes, the distribution of nitrogen is mulch, root and soil for six different biomes is shown. Which biome is represented in each of the following figures : A, B



The biomass of the zooplanktons is higher than that of the phytoplanktons because

- (a) the zooplanktons convert energy more efficiently
- (b) the zooplanktons have a shorter life cycle than the phytoplanktons
- (c) the phytoplanktons are individually much smaller than the zooplanktons
- (d) the phytoplanktons have an extremely high turnover rate

33. Bottom dwelling invertebrates that produce young ones may do so by one of the following ways :

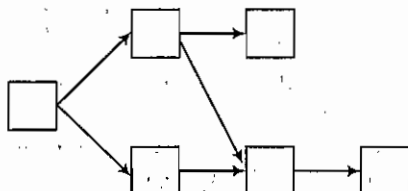
- I. They may produce large number of very small eggs which quickly hatch into larvae. These larvae are free-swimming and feed on phytoplankton present in water column.
- II. They may lay fewer eggs with yolk. When hatched, these larvae do not feed on plankton and spend less time in water column before settling.
- III. They may produce very few eggs that undergo entire development in the eggs and emerge out as juveniles on the sea beds.

For each of the following conditions, select a mode that will be favoured.

34. Members of a macroscopic food chain of a marine ecosystem are enlisted below. Numbers in front of them indicate the carbon assimilated in $g/m^2/year$.

- 1. Filter feeders 500
- 2. Surf zooplankton 400
- 3. Surf diatoms 350
- 4. Fishes 140
- 5. Benthic carnivores 40
- 6. Piscivorous fishes 8

Place them in the appropriate boxes in the following food chain (Each member should be used only once).



31. Which one of the following includes all the other?

- (a) Osmotroph
- (b) Parasite
- (c) Sanguivore
- (d) Heterotroph

32. The pyramid shows the relative biomass of zooplankton and phytoplankton in a marine ecosystem.

	A	B	C
(a)	Tundra	Temperate deciduous forest	Tropical deciduous forest
(b)	Tropical deciduous forest	Tundra	Temperate deciduous forest
(c)	Temperate deciduous forest	Tropical deciduous forest	Tundra
(d)	Tundra	Temperate deciduous forest	Tropical evergreen forest

35. During ecology practical exercise, a student studied some types of soil millipedes and presented the data as follows :

Millipede species	Average body weight (mg)	Daily food consumed as % of body weight	Food consumed by animal in 5 days (mg of air-dried matter)
1.	51.2	70	60
2.	116.4	46	88.5
3.	186.5	43	133.2

Study the table and mark the correct statement from those given below:

- (a) There is an error in the data as total food consumed by millipede species 1 is less than the daily food intake
 (b) Data is incorrect as the daily food intake should be highest for the largest animal, i.e., Species 3
 (c) The data is correct and indicates that the rate of metabolism is highest for the smallest animal species
 (d) The data is incorrect as it indicates that species 1. Though smallest in size, has the largest total body surface area and hence consumes more food daily

36. To obtain the total surface area of each of these species, following formula was used :

$$\text{Surface} = k \times g^{2/3}$$

where g is the weight of the animal. Finally, the surface area to total body weight was calculated, following data was obtained:

Species 1 : 4.3 : 1

Species 2 : 3.7 : 1

Species 3 : 3.1 : 1

The above data indicates that

- (a) rate of metabolism is directly proportional to body weight
 (b) rate of metabolism is directly proportional to body weight/surface area
 (c) rate of metabolism is directly proportional to total surface area
 (d) rate of metabolism is directly proportional to surface area/body weight

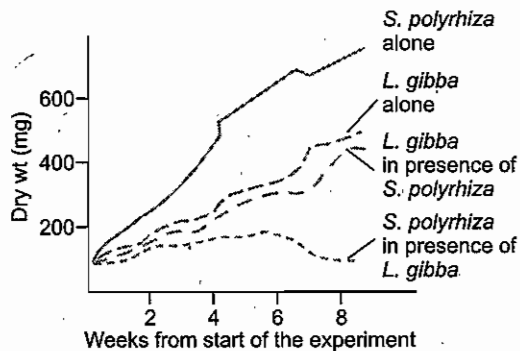
37. Below are listed some anatomical/physiological adaptations of brown alga *Fucus vasiculosus*. Match each one with one survival advantage by writing the correct alphabet (a-g) in the table in the answer sheet.

Choose from the options given below.

Adaptation	Advantage
Dichotomous branching of thallus	
Presence of fucoxanthin	
Mucilaginous secretions	
Lower solute potential than the surroundings	

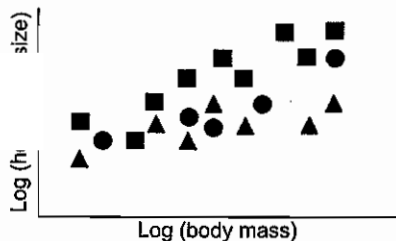
Options :

- (a) Optimum absorption of red light
 (b) Strength against pounding waves and stones
 (c) Protection against desiccation at low tides
 (d) Prevention of water loss by osmosis
 (e) Optimum buoyancy at high tides
 (f) Effective movement of motile gametes
 (g) Optimal absorption of blue light
38. *Spirodela polyrhiza* and *Lemna gibba* are two small monocotyledons, which float on the surface of quite fresh water bodies. When these were grown in nutrient culture media, the following data were obtained.



The type of interaction between the two species is most likely to be

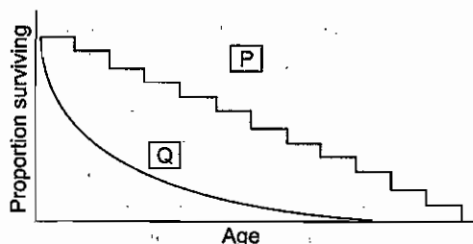
- (a) commensalism (b) amensalism
 (c) parasitism (d) competition
39. The relationship between the home range size and body weight of three kinds of mammals is depicted in the graph



The three symbols are likely to represent mammals exhibiting

	▲	●	■
(a)	Carnivory	Herbivory	Omnivory
(b)	Herbivory	Omnivory	Carnivory
(c)	Omnivory	Carnivory	Herbivory
(d)	Omnivory	Herbivory	Carnivory

40. The following survivorship curves are of two different animals, P and Q. Choose the correct pair that respectively identifies P and Q.



- I. Mouse II. Crab
 III. Oyster IV. Lizard
 (a) I and II
 (b) II and III
 (c) III and IV
 (d) I and IV

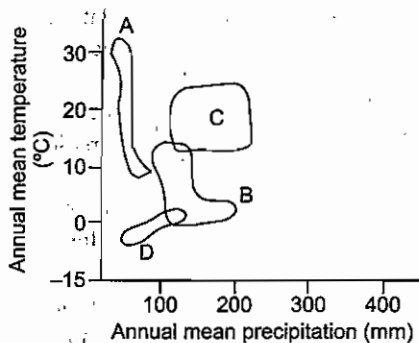
41. In an experiment, three bottles were filled with water from an aquatic ecosystem. This water contained tiny plants and animals of the ecosystem. The following experiments were done with the bottles.

Bottle Number	Condition	Oxygen Measurement	Oxygen (mg/L)
1	Control	Done immediately	9
2	Light for one hour	Done after one hour	10
3	Dark for one hour	Done after one hour	4

The gross primary productivity for this ecosystem is

- (a) 1 mg/L/h (b) 5 mg/L/h
 (c) 6 mg/L/h (d) 14 mg/L/h

42. A climograph of various biomes is given below. The biomes A, B, C and D represent



	A	B	C	D
(a)	Coniferous forest	Tundra	Temperate broadleaf forest	Desert
(b)	Desert	Coniferous forest	Temperate broadleaf forest	Tundra
(c)	Coniferous forest	Desert	Temperate broadleaf forest	Tundra
(d)	Desert	Tundra	Coniferous forest	Temperate broadleaf forest

43. What is the correct match of example to ecological term?

	A	B	C	D
(a)	Freshwater shrimps	All lake organisms	Pond weed as primary producer	Freshwater lake
(b)	Freshwater lake	Pond weed as primary producer	Freshwater shrimps	All lake organisms
(c)	All lake organisms	Freshwater lake	Freshwater shrimps	Pond weed as primary producer
(d)	Freshwater shrimps	Freshwater lake	All lake organisms	Pond weed as primary producer

44. Defending a territory requires time and energy. Any animal should only defend territories if the benefits of defence outweigh the costs. Consider a sunbird that feeds only on the nectar of flowers. When the sunbird obtained an average of 1 microlitre of nectar per flower, it needed 8 hours of foraging to meet its daily energy requirements. This time was reduced to 4 h if it gained 2 microlitres of nectar per flower and to 2.7 h if it gained 3 microlitres of nectar per flower.

Metabolic costs associated with various activities of sunbird are as follows :

Foraging for nectar : 1000 cal/h

Sitting on a perch : 400 cal/h

Territory defence : 3000 cal/h

If the bird defends the territory then its net gain of nectar per flower increases from 2 microlitres to 3 microlitres but the bird needs to spend 0.28 h per day for defence.

Calculate the following :

A. If the bird does not defend the territory

1. The daily energy spent in foraging =

2. The daily energy spent in defending =

3. The daily energy spent in perching =

B. If the bird defends its territory

1. The daily energy spent in foraging =

2. The daily energy spent in defending =

3. The daily energy spent in perching =

4. The correct interpretation

(a) In the above situation, the bird is likely to show territory defence as the net perching cost is reduced

(b) In the above situation, the bird is not likely to show territory defence as the cost associated with it is greater than the energy spent in foraging

(c) In the above situation, the bird is likely to show territory defence as the net benefit by defending a territory is higher than by not defending it.

(d) In the above situation, the bird is not likely to show territory defence as the cost associated with perching and defence both overcome the energy saved in foraging

45. The life history of an organism is a result of differential allocation of resources towards survival and reproduction. In order to study the impact of predation on the life history of guppies, following three sites were chosen.

These three sites differed only with respect to the predator species and the type of predation as follows :

(i) Site 1 had a cichlid (*Crenicichla alta*) as a predator with moderate predation, predominantly feeding on juvenile guppies.

(ii) Site 2 had a killifish (*Rivulus hartii*) as a predator with low predation, predominantly feeding on juvenile guppies.

(iii) Site 3 had a killifish (*Aequidens pulcher*) as a predator with low predation, on all size classes of guppies.

Indicate whether each of the following strategies will lead to maximum survival of the guppies at each site.

1. More allocation of resources towards reproduction in guppies at site 1 as compared to site 2 and 3.

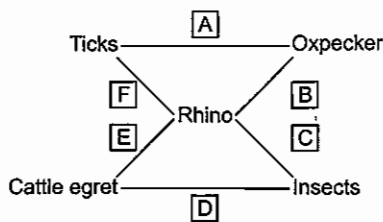
2. Reduced time between the two successive reproductive cycles in guppies at site 2 as compared to site 1.

3. Large number of offspring in site 1 as compared to site 2.

4. Each offspring of larger size in site 1 as compared to site 2 and 3.

46. On African plain, large herbivores like black rhinoceros disturb insect communities as they move. Birds like cattle egret feeds on the displaced insects. Neither the displacement of insects nor the activity of birds has any effect on the rhino. Oxpecker (a small dark bird) removes ticks from the skin of the rhino. The bird gets food and the mammals get relief from parasites. An outline of these inter-relationships is given right side

Match the alphabets with the relationship that the organisms possess among themselves and then write only appropriate number in the space against each alphabet.



- | | |
|-----------------|----------------|
| 1. Predation | 2. Parasitism |
| 3. Commensalism | 4. Amensalism |
| 5. Mutualism | 6. Competition |

Answers

Exercise I

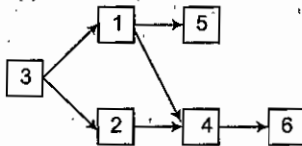
- | | | | | | | | |
|---------|---------|---------|---------|---------|---------|---------|---------|
| 1. (a) | 2. (d) | 3. (d) | 4. (b) | 5. (c) | 6. (b) | 7. (b) | 8. (d) |
| 9. (c) | 10. (a) | 11. (e) | 12. (d) | 13. (e) | 14. (b) | 15. (c) | 16. (c) |
| 17. (a) | 18. (d) | 19. (c) | 20. (a) | 21. (d) | 22. (b) | 23. (c) | 24. (b) |
| 25. (c) | 26. (b) | 27. (c) | 28. (c) | 29. (d) | 30. (b) | 31. (d) | 32. (b) |
| 33. (b) | 34. (b) | 35. (c) | 36. (a) | 37. (d) | 38. (a) | 39. (d) | 40. (c) |
| 41. (b) | 42. (e) | 43. (b) | 44. (b) | 45. (c) | 46. (c) | 47. (a) | 48. (b) |
| 49. (b) | 50. (c) | 51. (c) | 52. (a) | 53. (b) | 54. (b) | 55. (d) | 56. (d) |
| 57. (a) | 58. (a) | 59. (d) | 60. (a) | 61. (b) | 62. (d) | 63. (b) | 64. (c) |
| 65. (a) | 66. (d) | 67. (c) | 68. (e) | 69. (c) | 70. (e) | 71. (a) | 72. (a) |
| 73. (b) | 74. (d) | 75. (d) | 76. (a) | | | | |

Exercise II

- | | | | | | | | |
|---------|---------|---------|---------|---------|---------|---------|---------|
| 1. (d) | 2. (c) | 3. (c) | 4. (a) | 5. (b) | 6. (c) | 7. (a) | 8. (c) |
| 9. (b) | 10. (a) | 11. (d) | 12. (a) | 13. (b) | 14. (b) | 15. (c) | 16. (a) |
| 17. (c) | 18. (a) | 19. (e) | 20. (b) | | | | |

Explanation

21. (1) 100% X, 16% Y (2) 100% X, 100% Y
 22. 1-C, 2-D, 3-B, 4-A, 5-F, 6-G, 7-E
 23. A, C, D, G-Correct, B, E, F, H → Incorrect
 24. (a)
 25. (i) (d), (ii) (c), (iii) (a) 26. (i) PS + R, (ii) (4) (PS + R) will increase 27. 1-A, 2-E, 3-C/D, 4-C, 5-A/B
 28. (d) 29. (b) 30. (i) (a) 31. (c) 32. (c)
 33. Condition A B C D E 34.
 Mode I III II & III I II



35. (c) 36. (d)

37.

Adaptation	Dichotomous branchy of thallus	Presence of fucoxanthin	Mucilaginous secretions	Lower solute potential than the surroundings
Advantage	b	g	c	d

38. (d) 39. (b) 40. (b) 41. (d) 42. (b) 43. (c)
 44. (A) 1 = 4000 calorie, 2 = 0 calorie, 3 = 8000 calorie (B) 1 = 2700 calorie, 2 = 840 calorie, 3 = 8408 calorie (C) -c
 45. 1 (Yes), 2 (No), 3 (Yes), 4 (No) 46. A-I, B-5, C-4, D-1, E-3, F-2