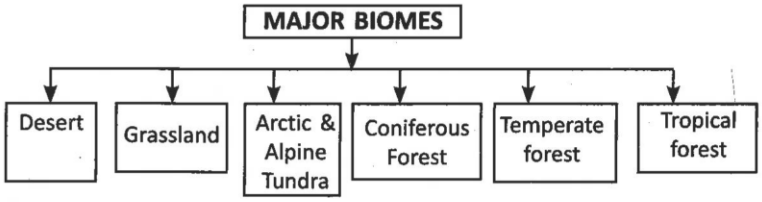
CHAPTER : 13

ORGANISMS AND POPULATIONS

STUDY-NOTES

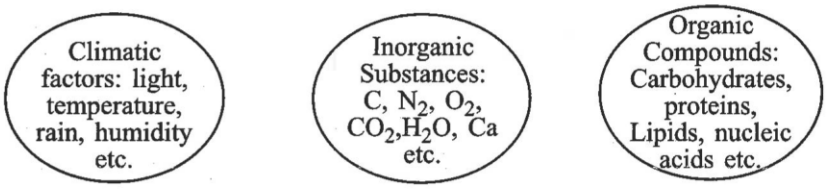
I. Organism and its Environment

- The rotation of the earth and tilt of its axis is the reason for annual variations in both the intensity and duration of temperature. It results in diverse seasons.
- These variations together with annual variation in precipitation (both rain and snow) is the reason for the formation of major biomes. For example, desert, rain forest and tundra etc. More often regional and local variations within each biome form widespread habitats.
- **Major biomes of India**
  (a) Tropical rain forest
  (b) Deciduous forest
  (c) Desert
  (d) Sea coast



- **Niche:** Every organism has defined range of conditions that it can tolerate, diverse the resources it utilizes and a distinct functional role in the ecological system, all these together comprise its niche.

A. Major Abiotic Factors



(i) Temperature

- Average temperature on land varies seasonally, decreases gradually from the equator to poles and from plains to the mountains. It ranges from subzero to >50°C in poles and tropical deserts respectively.
- In thermal springs and deep-sea hydrothermal vents average temperatures go beyond 100°C.
- Temperature significantly affects the kinetics of enzymes, metabolic activity and other physiological functions of the organism. That's why snow leopards are not found in Kerala, and tuna fish are not found beyond tropical latitudes in the ocean.
- Temperature also causes the tolerance range in organisms because of which they can be grouped as –
  (a) Eurythermal: Organisms that can survive in a wide range of temperature.
  (b) Stenothermal: Organisms that survive in a narrow range of temperatures.

	Eurythermal organisms	Stenothermal organism
(1)	These are the organisms that can tolerate wide range of temperature.	These are the organisms that are restricted to narrow range of temperature.
(2)	These organisms typically are found in coastal waters.	These organisms are typically found in open ocean.
(3)	Examples: Mammals like goat, man, cow, etc.	Example: Coral reefs and some reptiles.

(ii) **Water**

- Water is the most important factor influencing the life of organisms on the earth. No life is possible without water on the earth.
- Limited availability of water in deserts causes special adaptations in organisms to survive there.
- Presence of organisms in aquatic environment depends on water quality such as chemical composition, pH of water etc.
- Salinity level of different aquatic bodies are different. For example, salt concentration < 5 in inland waters, 30-35 in the sea and > 100 in some hypersaline lagoons.
- Generally, freshwater organism cannot live in sea water and vice versa because of the osmotic challenges.
- Depending on the salt tolerance, organisms can be:
  - **(a) Eeuryhaline:** organism tolerate a wide range of salinities
  - **(b) Stenohaline:** organisms restricted to a narrow range of salinity

(iii) **Light**

- In forests, the abundance of tall and high canopied trees causes many small plants species to adapt for low light conditions.
- Many plants depend on sunlight for photoperiodic requirement of plants for flowering.
- In many animals, the diurnal and seasonal variations as well as duration (photoperiod) of light intensity and determines foraging, reproductive and migratory activities.
- Light and temperature are correlated. But, deep (>500m) in the oceans, sunlight does not reach there.
- The spectral quality of solar radiation is also important for life. The UV rays of the spectrum is harmful whereas visible spectrum are not.

(iv) **Soil**

- The nature and properties of soil depends on the climate, the weathering process, and the types of soil, whether transported or sedimentary. Therefore, they vary in different places.
- Various characteristics of the soil such as soil composition, grain size and aggregation determine the percolation and water holding capacity of the soils.
- These features along with pH, mineral composition and topography determine types of vegetation in any area. This in turn directs fauna of that place.
- Similarly, sediment-characteristics in the aquatic environment determine the type of benthic animals that area.

B. Responses to Abiotic Factors

(i) **Regulate**

- Some organisms maintain homeostasis that confirms constant body temperature, and osmotic concentrations, etc.
- Thermoregulation and osmoregulation is evident in birds and mammals, and in lower vertebrate and invertebrates.

- Mammals are successful organism on the earth due to their ability to maintain a constant body temperature and thrive in extreme habitats condition.
- Humans maintain a constant body temperature of 37°C by sweat profusely in summer. The evaporative cooling controls body temperature.
- During winter shivering causes rise in heat and body temperature. However, plants do not have such mechanisms to maintain internal temperatures.

(ii) **Conform**

- Animals and all plants cannot maintain a constant internal environment. Their body temperature changes with the ambient temperature.
- In aquatic animals, the osmotic concentration of the body fluids changes with that of the ambient air, water and osmotic concentrations. These animals and plants are called **conformers.**
- Thermoregulation is energetically expensive process. Heat loss or heat gain is a function of surface area.
- Small animals have a larger surface area relative to their volume. Therefore, they lose body heat more when it is cold outside. They expend much energy to generate body heat through metabolism. That's why very small animals are hardly found in polar regions.

(iii) **Migrate**

- Organisms show temporary movement to avoid environmental stress.
- They return to their original habitats when stressful period is over.
- Many animals, mostly birds, move to hospitable areas during harsh winter conditions.
- For example, movement of Siberian cranes in chilled winter to Keolado National Park (Bharatpur) in Rajasthan.

(iv) **Suspend**

- Organisms suspend their metabolic activities under harsh environmental conditions.
- For example, bacteria, fungi and lower plants produce thick-walled spores which help them to survive unfavorable conditions but germinate on availability of suitable environment.
- In higher plants, besides dispersal, seeds and some other vegetative reproductive structures help them to survive various environmental stresses.
- Plants reduce their metabolic activities and undergo a state of 'dormancy'. They germinate to form new plants under favourable moisture and temperature.
- Sometimes animals unable to migrate and avoid stress by escaping in time. For example, bears hibernate during winter. Similarly, some snails and fish undergo aestivation to avoid heat and desiccation during summer.
- Many zooplanktons enter a stage of suspended development known as diapause under unfavorable conditions.

C. Adaptations

Adaptation is a morphological, physiological, and behavioural attribute of the organism that enables the organism to survive and reproduce in its habitat. Adaptations that have evolved over a long evolutionary time are genetically fixed. Some examples are:

- In absence of any external source of water, kangaroo rat in North American deserts fulfils its water requirements through its internal fat oxidation. It also concentrates its urine to remove excretory products in less volume of water.
- Desert plants possess (i) thick cuticle on their leaf surfaces (ii) stomata arranged in deep pits (sunken) to minimise water loss through transpiration (iii) a special, CAM, photosynthetic pathway that enables their stomata to remain closed during day time.
- In some desert plants, leaves have been reduced to spines and the photosynthetic function is performed by the flattened stems. For example, *Opuntia.*
- According to **Allen's Rule**, mammals of colder climates have shorter ears and limbs to minimise heat loss. Polar aquatic mammals like seals possess thick layer of fat (blubber) below their skin. It acts as an insulator and reduces loss of body heat.
- Some adaptations are quick. At high altitudes, **altitude sickness** is most common.

- Organisms living at great depths in the ocean where the pressure could be >100 times the normal atmospheric pressure show an interesting biochemical adaptations.
- Desert lizards lack the physiological ability that may help them to cope up with variations in their environment. Therefore, they keep their body temperature constant by behavioural responses.

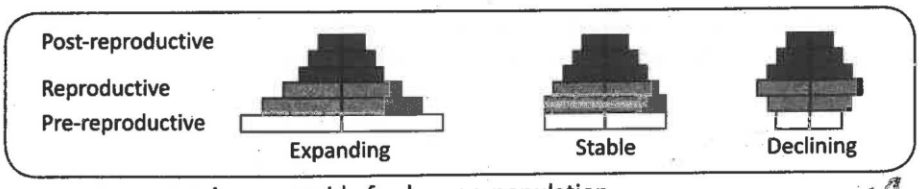
II. Populations

A. Population Attributes

(a) Birth rate: The number of births per 1,000 total populations.

(b) Death rate: The number of deaths per 1,000 total populations.

(c) Sex ratio: At a given time, a population is composed of individuals of different ages. If the age distribution (per cent individuals of a given age or age group) is plotted for the population, the resulting structure is called an **age pyramid**. For human population, age pyramids show age distribution of males and females in a diagram. The shape of the pyramids reveals the growth status of the population whether it is (a) growing, (b) stable or (c) declining.



Age pyramids for human population.

(d) Population Size: Population size states about its status in the habitat. The size may be low (<10 Siberian cranes at Bharatpur wetlands in any year) to millions (*Chlamydomonas* in a pond). Population size is also called population density (designated as N).

B. Population Growth

(a) **Natality**: The number of births during a given period in the population that are added to the initial density.

(b) **Mortality:** The number of deaths in the population during a given time period.

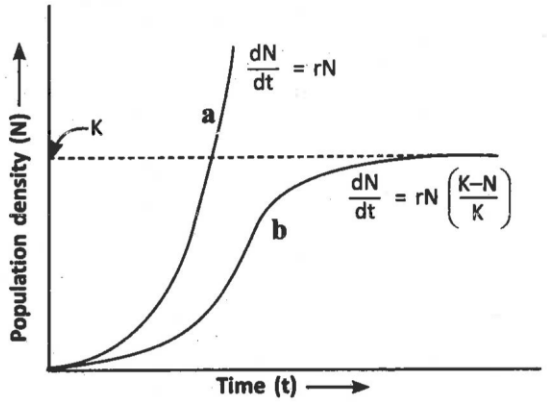
(c) **Immigration:** The number of individuals of the same species that have come into the habitat from elsewhere during the time period under consideration.

(d) **Emigration:** The number of individuals of the population who left the habitat and gone anywhere else during the time period under consideration.

C. Growth Models

(a) Exponential growth

- When resources in the habitat are unlimited, each species has innate potential to grow in number, then the population grows exponentially.
- It is an important parameter for assessing impacts of any biotic or abiotic factor on population growth. The equation describes the exponential or geometric growth of a population.
- When we plot N in relation to time, a J-shaped curve will be obtained.



Population growth curve a when responses are not limiting the growth, plot is exponential, *b* when responses are limiting the growth, plot is logistic, K is carrying capacity

(b) Logistic growth

- In a given habitat, the nature supports a maximum possible number, beyond which no further growth is possible. This limit is called nature's carrying capacity (K) for that species in that habitat.
- Under limited resources in a habitat, a growing population initially show a lag phase, followed by phases of acceleration and deceleration and finally an asymptote, when the population density reaches the carrying capacity. A plot of N in relation to time (t) results in a **sigmoid curve**. This type of population growth is called Verhulst-Pearl Logistic Growth. It is described by the following equation:

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

Where

N = Population density at time t
r = Intrinsic rate of natural increase
K = Carrying capacity

D. Life History Variations

- Populations evolve to maximize their reproductive fitness, also called Darwinian fitness (high r value), in the habitat in which they live.
- Organisms evolve in the direction of the most efficient reproductive strategy. Some organisms breed only once in their lifetime.
- For example, Pacific salmon fish, bamboo, whereas others breed many times during their lifetime. Eg., most birds and mammals.
- Some organism produces a large number of small-sized offspring. For example, Oysters, pelagic fishes while others produce a small number of large-sized offspring e.g., birds, mammals.

E. Population Interactions

- In natural habitat organisms are found to interact with each other. They can never be found alone. Different types of interactions of organisms in nature are:

(i) Predation

- Predators keep prey populations under control. But for predators, prey species could achieve very high population densities and cause ecosystem instability.
- Some exotic species when introduced in an area, they become invasive and spread very fast as the invaded land does not possess natural predators.
- Prickly pear cactus introduced caused havoc in Australia by spreading rapidly. It was controlled by introduction of a cactus-feeding predator (a moth) from its natural habitat.
- In the rocky intertidal starfish *Pisaster* communities of the American Pacific Coast is an important predator.
- More than 10 species of invertebrates became extinct within a year, because of interspecific competition.
- Efficient predators cause overexploitation of prey and may cause extinction of them. It may result in extinctions of predators itself.
- Some prey species have evolved specific defenses mechanism to protect from the effects of predation.

(ii) Competition

Both the interacting species lose in competition. Competition occurs when closely related species compete for the same resources that are limiting. However, entirely unrelated species also competes for the same resource.

- **Interference competition:** In this type of competition, the feeding efficiency of one species decreases due to the interfering and inhibitory presence of the other species, even if resources (food and space) are abundant.

- In a small geographical area, the distribution range of a species increases when the competitively superior species is experimentally removed.
- **Gause's Competitive Exclusion Principle:** Two closely related species competing for the same resources cannot co-exist indefinitely and the competitively inferior one will be eliminated eventually. This is true when resources are limiting.
- **Resource partitioning:** If two species compete for the same resource, they avoid competition either by choosing different times for feeding or different foraging patterns. MacArthur showed that five closely related species of warblers living on the same tree were avoid competition and co-exist due to differences in their foraging activities.

(iii) **Parasitism**

- Parasites are host-specific. They co-evolve with their host. Parasites evolve mechanisms to counteract the defense mechanism of their hosts.
- Parasites have special adaptations such as
  (a) loss of unnecessary sense organs
  (b) presence of adhesive organs or suckers to cling on to the host
  (c) loss of digestive system
  (d) high reproductive capacity
  (e) two intermediate hosts or vectors to complete its life cycle. For example, human liver fluke has two intermediate hosts (a snail and a fish)
- The malarial parasite has mosquitoes as their vector.
- **Brood parasitism** in birds is an interesting example of parasitism. The parasitic bird lays its eggs in the nest of its host and lets the host incubate them. Eggs of the parasitic bird resembles the host's egg in size and colour. As a result, the host bird cannot differentiate between eggs of self and that of parasitic bird. For example, cuckoo and crow show brood parasitism.

(iv) **Commensalism**

- In commensalism, one species is benefitted and the other is neither benefitted nor harmed.
- An epiphytic orchid growing on a mango branch, and barnacles growing on the back of a whale show commensalism.
- The cattle egret and grazing cattle are also commensals. Similarly, sea anemone and the clown fish show commensalism.

(v) **Mutualism**

- Both the species benefit in mutualism. For example, Lichens are mutual relationship between algae and fungi.
- Similarly, mycorrhizal associations between fungi and the roots of higher plants show mutualism.
- Furthermore, animals help in pollination and dispersal of seeds. In return, plants provide pollen and nectar to their pollinators.
- Figs show one to one relationship with their pollinator wasps. The female wasp lay their eggs inside the fruit and uses the developing seeds within the fruit for nourishing its larvae. The wasp pollinates the fig inflorescence while searching for suitable egg-laying sites.
- Orchids have evolved a confusing diversity of floral patterns. In *Ophrys, one* petal of its flower bears weird resemblance to the female bee in size, colour and markings. The male bee is attracted to it and hence 'pseudocopulates' with the flower.

QUESTION BANK

MULTIPLE CHOICE QUESTIONS

1. In which of the following relationship, both the species gets benefited?

(a) Parasitism (b) Mutualism (c) Competition (d) Predation

2. The stage in which organism suspends its development is known as

(a) Diapause (b) Suspend (c) Migrate (d) Aestivation

3. Select the correct statement(s).

(a) Human intestine is a unique habitat for hundreds of species of microbes.

(b) Physico-chemical (abiotic) components alone do not characterise the habitat of an organism completely.

(c) Through natural selection, adaptations evolve to optimise the survival and reproduction in an individuals habitat.

(d) All are correct

4. Parasites that live inside the small intestine of the host body are called

(a) Parasites (b) Endoparasites (c) Brood parasites (d) Ectoparasites

5. The average temperature in deep-sea hydrothermal vents exceeds

(a) 50°C (b) 100°C (c) 120°C (d) 200°C

6. The number of deaths in the population during a given period is referred to

(a) Natality (b) Mortality (c) Sex-ratio (d) Population size

7. Match the following:

Column I	Column II
(i) Temporary moving from one place to another	A. Hibernation
(ii) Winter sleep	B. Diapause
(iii) A stage of suspended development	C. Aestivation
(iv) Avoid summer heat	D. Commensalism
(v) One species benefit in	E. Migration

Select the correct option:

(a) (i)-A, (ii)-C, (iii)-D, (iv)-B, (v)-E (b) (i)-A, (ii)-C, (iii)-D, (iv)-E, (v)-B

(c) (i)-E, (ii)-A, (iii)-B, (iv)-D, (v)-C (d) (i)-E, (ii)-A, (iii)-B, (iv)-C, (v)-D

8. The age pyramids of a human population usually show the age distribution of

(a) Males only (b) Females only

(c) Both males and females (d) None of these

9. Eurythermal organisms live in a habitat with

(a) Subzero temperature (b) Low range of temperature

(c) Large-scale variations in temperature. (d) Above 100°C temperature

10. Which of the following is not an ectoparasite?

(a) Lice in humans (b) Copepods in marine fishes

(c) Mistletoe on other plants (d) Female *Anopheles* on humans

11. To avoid extreme heat of summer, organisms undergo the process

(a) Hibernation (b) Suspend (c) Migrate (d) Aestivation

12. **Select the correct statement(s).**
    (a) Stenothermal organisms can tolerate and thrive in a wide range of temperatures.
    (b) The levels of thermal tolerance of different species determine to a large extent of their geographical distribution.
    (c) Special adaptations make it possible for organisms to live in deserts.
    (d) Both (b) and (c)

13. **To get pollinated by a bee, the Mediterranean Orchid, *Ophrys*, employs**
    (a) Sexual deceit
    (b) Pseudocopulation
    (c) Reward in the form of nectar
    (d) Place for laying eggs

14. **Which of the following represents the carrying capacity?**

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

    (a) dN
    (b) rN
    (c) K
    (d) dt

15. **Autecology is the**
    (a) Relation of heterogenous populations to its environment
    (b) Relation of an individual to its environment
    (c) Relation of a community to its environment
    (d) Relation of a biome to its environment

16. **The importance of predators is/are**
    (a) Keep prey populations under control
    (b) Act as channels for energy transfer
    (c) Both (a) and (b)
    (d) None

17. **The plant *Cuscuta* is a**
    (a) Total root parasite
    (b) Total stem parasite
    (c) Partial root pasrasite
    (d) Partial stem parasite

18. **Ecotone is**
    (a) A polluted area
    (b) The bottom of a lake
    (c) A zone of transition between two communities
    (d) A zone of developing community

19. **Many organisms undergo the process called winter sleep. It is also known as**
    (a) Hibernation
    (b) Suspend
    (c) Migrate
    (d) Aestivation

20. **The size of the population expresses its status in the**
    (a) Habitat
    (b) Sex-ratio
    (c) Age pyramid
    (d) Environment

21. **Ecological niche is**
    (a) the surface area of the ocean
    (b) an ecologically adapted zone
    (c) the physical position and functional role of a species within the community
    (d) formed of all plants and animals living at the bottom of a lake

22. **The species whose distribution is restricted to a small geographical area because of the presence of a competitively superior species is found to expand its distributional range dramatically when the competing species is experimentally removed. This is called**
    (a) Competitive exclusion
    (b) Competitive inclusion
    (c) Competitive release
    (d) Competitive supremacy

23. A protozoan reproduces by binary fission. What will be the number of protozoans in its population after six generations?

(a) 128 (b) 24 (c) 64 (d) 32

24. The relationship in which one species is benefitted whereas other is neither benefitted nor harmed is known as

(a) Commensalism (b) Amensalism (c) Mutualism (d) Parasitism

25. Biosphere is

(a) a component in the ecosystem

(b) composed of the plants present in the soil

(c) life in the outer space

(d) composed of all living organisms present on earth which interact with the physical environment

26. While heat gain or heat loss is the function of _____ heat production is the function of _____ of the body of an animal.

(a) Volume, Surface area (b) Surface area, Volume

(c) Volum, Volume (d) Surface area, Surface area

27. Parasites residing on the external surface of the host are called

(a) Parasitism (b) Brood parasitism (c) Ectoparasites (d) Endoparasites

28. According to Allen's Rule, the mammals from colder climates have

(a) shorter ears and longer limbs (b) longer ears and shorter limbs

(c) longer ears and longer limbs (d) shorter ears and shorter limbs

29. In which of the following relationship, both species lose?

(a) Mutualism (b) Competition (c) Parasitism (d) Predation

30. Which of the following would necessarily decrease the density of a population in a given habitat?

(a) Natality and mortality (b) Immigration and emigration

(c) Mortality and emigration (d) Natality and immigration

31. Which of the following is the breeding place for Flamingoes in India?

(a) Chilka lake (b) Sambar lake (c) Runn of Kuchh (d) Silent valley

32. Salt concentration (Salinity) of the sea measured in parts per thousand is

(a) 10 – 15 (b) 30 – 70 (c) 0 – 5 (d) 30 – 35

33. Parasitism is the relationship in which

(a) Only one species is benefitted (b) Only one species loses

(c) Both the species lose (d) Both the species get benefitted

34. Identify the biome that is not correctly matched with the physical parameters given in corresponding Column II and Column III:

	Biome	Mean annual temperature [°C]	Mean annual precipitation [cm]
(a)	Tropical forest	20 to 25	130 to 430
(b)	Arctic and alpine tundra	–12 to 2	10 to 125
(c)	Coniferous forest	–5 to 5	100 to 200
(d)	Temperate forest	8 to 22	50 to 225

35. Any freshwater animals cannot live for long in sea water and vice versa because

(a) Temperature exchanges (b) Thermolabile enzymes

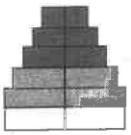
(c) Due to osmotic changes (d) Change in pressure

36. Formation of tropical forests needs mean annual temperature and mean annual precipitation as

(a) 18 – 25°C and 150 – 400 cm (b) 5 – 15°C and 50 – 100 cm

(c) 30 – 50°C and 100 – 150 cm (d) 5 – 15°C and 100 – 200 cm

37. **The given age pyramid represents:**



(a) Expanding population
(b) Declining population
(c) Stable population
(d) Very Slowly declining population

38. **Acclimatization to altitude sickness includes all except**
(a) Polycythemia
(b) Decreasing binding capacity of Hb
(c) Asphyxia
(d) None of these

39. **Which of the following forest plants controls the light conditions at the ground?**
(a) Lianas and climbers (b) Shrubs (c) Tall trees (d) Herbs

40. **What will happen to a well growing herbaceous plant in the forest if it is transplanted outside the fores in a park?**
(a) It will grow normally.
(b) It will grow well because it is planted in the same locality.
(c) It may not survive because of change in its micro climate.
(d) It grows very well because the plant gets more sunlight.

41. **If a population of 50 *Paramecium* present in a pool increases to 150 after an hour, what would be th growth rate of population?**
(a) 50 per hour (b) 200 per hour (c) 5 per hour (d) 100 per hour

42. **In a field experiment, when all *Pisaster* starfish were removed from an enclosed intertidal area, the outcom was**
(a) Invertebrates diversity increases
(b) Many invertebrates became extinct
(c) *Pisaster* never can enter the same area again
(d) *Pisaster* was replaced by other starfish

43. **In 2005, for each of the 14 million people present in a country, 0.028 were born and 0.008 died during th year. Using exponential equation, the number of people present in 2015 is predicted as**
(a) 25 million (b) 17 million (c) 20 million (d) 18 million

44. **What parameters are used for tiger census in our country's national parks and sanctuaries?**
(a) Pug marks only
(b) Pug marks and faecal pellets
(c) Faecal pellets only
(d) Actual head counts

45. **Which of the following is a partial root parasite?**
(a) Sandal wood (b) Mistletoe (c) Orobanche (d) Ganoderma

46. **Which one of the following organisms reproduces sexually only once in its life time?**
(a) Banana plant (b) Mango (c) Tomato (d) Eucalyptus

47. **Which of the following is NOT the function of predator?**
(a) They act as conduits for energy transfer across trophic levels.
(b) They keep prey populations under control.
(c) They help in the stabilisation of the ecosystems.
(d) They decrease the species diversity in a community.

48. **The logistic growth curve of animal population growth is more realistic than J shaped curve because**
(a) Asexual mode of reproduction is rare in higher animals.
(b) Resources are finite and become limiting sooner or later
(c) Most animals are conformers rather than regulators
(d) Abiotic factors affect animals more than plants.

49. A population has more young individuals compared to the older individuals. What would be the status of the population after some years?

(a) It will decline. (b) It will stabilise.
(c) It will increase. (d) It will first decline and then stabilise.

50. Amensalism is an association between two species where

(a) one species is harmed and other is benefitted (b) one species is harmed and other is unaffected
(c) one species is benefitted and other is unaffected (d) both the species are harmed.

51. Lichens are the associations of

(a) bacteria and fungus (b) algae and bacterium (c) fungus and algae (d) fungus and virus

52. Match the following

Column I	Column II
I. Allen's Rule	A. Kangaroo Rat
II. Physiological adaptation	B. Desert Lizard
III. Behavioural adaptation	C. Marine fish at depth
IV. Biochemical adaptation	D. Polar seal

Select the correct option.

(a) I-D, II-A, III-B, IV-C (b) I-D, II-A, III-C, IV-B
(c) I-B, II-A, III-D, IV-C (d) I-D, II-B, III-A, IV-C

53. Which of the following is not an attribute of a population?

(a) Natality (b) Mortality (c) Species interaction (d) Sex ratio

54. Between which among the following, the relationship is not an example of commensalism?

(a) Cattle egret and grazing cattle (b) Orchid and the tree on which it grows
(c) Sea anemone and clown fish (d) Female wasp and fig species

55. Select the correct statements.

A. Soil composition, grain size and aggregation determine the percolation and water holding capacity of the soils.
B. In the aquatic environment, the sediment-characteristics often determine the type of benthic animals that can thrive there.
C. The UV component of the spectrum is harmful to many organisms.
D. The organism should try to maintain the constancy of its internal environment

Select the correct statement(s).

(a) ABD only (b) BCD only
(c) ACD only (d) ABCD all are correct

56. Select the incorrect statements about regulation and regulators.

(a) Mammals maintain a constant body temperature
(b) Evaporative cooling helps in keeping the body temperature low.
(c) Plants have mechanisms to maintain internal temperatures.
(d) Some organisms maintain homeostasis by physiological means.

57. It is much easier for a small animal to run uphill than for a large animal because

(a) Smaller animals have a higher metabolic rate
(b) Small animals have a lower oxygen requirement
(c) The efficiency of muscles in large animals is less than in the small animals
(d) It is easier to carry a small body weight

58. In a growing population of a country

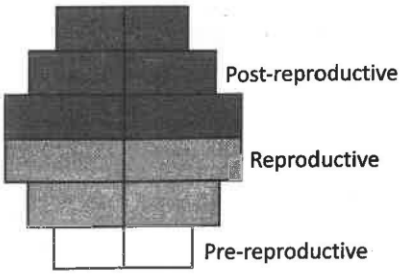
(a) Pre-reproductive individuals are more than reproductive individuals
(b) Reproductive individuals are less than post reproductive individuals
(c) Reproductive and pre-reproductive individuals are equal in number
(d) Pre-reproductive individuals are less than reproductive individuals

59. Select the correct option.

Column I	Column II
(i) Organism	A. Births and deaths
(ii) Population	B. Male/female
	C. Birth rates and death rates
	D. Sex ratio
	E. Age distribution

(a) (i)-A , B, E; (ii)-C, D
(b) (i)-A, B; (ii)-C, D, E
(c) (i)-A, B, D; (ii)-C, E
(d) (i)-C, D, E; (ii)-A, B

60. What type of human population is represented by the following age pyramid?



(a) Stable population
(b) Declining population
(c) Expanding population
(d) Vanishing population

61. The main reason building burrows in soil by burrowing animals is

(a) To escape from predators
(b) To derive nutrition parts of plants from underground
(c) To mode of evolution chose burrows as a specific habitat
(d) To hide and escape from the above ground heat

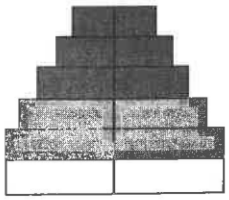
62. Choose the odd one out with respect to structure formed in the different organisms during suspended phase.

(a) Bacteria—Thick walled spores
(b) Higher plants—Seeds vegetative propagules
(c) Zooplankton—Diapause state
(d) Ectothermic Organism—Torpid state during favourable season

63. Population size in any given habitat is also known as

(a) Population cluster (b) Population explosion (c) Population abundance (d) Population density

64. The population with the following age pyramid



(a) Will grow exponentially in near future
(b) Will grow steadily in future
(c) Is likely to remain stable in future
(d) Is likely to decline in future

65. The type of population interaction exhibited by visiting flamingos and resident fishes in South American lakes is also shown by

(a) Sparrow eating any seed
(b) Cuckoo and crow
(c) Abingdon tortoise and goats in Galapagos island
(d) Sea anemone and clown fish

66. Ecology is basically concerned with four levels of biological organisation which one of the following is correct representation

(a) Population → Ecosystem → Biome → Landscape
(b) Communities → Population → Ecosystem → Biome
(c) Organisms → Population → Communities → Biome
(d) Species → Ecosystem → Communities→ Biome

67. Under a particular set of selection pressure, organisms evolve towards the most efficient

(a) Thermoregulation (b) Water conservation
(c) Respiration (d) Reproduction Strategy

68. Many freshwater animals cannot live for long in sea water and vice-versa because of

(a) Buoyancy related problems (b) Lack of impermeable skins
(c) Thermolabile enzymes (d) Osmotic considerations

69. Darwinian fitness is represented by

(a) Low r value (b) High r value (c) High K value (d) Low K value

70. Most animals are tree dwellers in a

(a) Coniferous forest (b) Thorn woodland
(c) Temperate deciduous forest (d) Tropical rainforest

71. Which of the following is the most ecologically relevant environmental factor?

(a) Temperature (b) Water (c) Light (d) Soil

72. If global warming continues, how would the distributional range of some species be affected?

(a) There will be a poleward shift (b) There will be an equatorial shift
(c) No change expected for any species (d) Shift to marine water from land

73. In a tide pool, 15 species of invertebrates were reduced to 8 after one species was removed. The removed species may be a

(a) Parasite (b) Mutualist (c) Top predator (d) Herbivore

74. When certain exotic species are introduced into a geographical area they become invasive mainly because

(a) The invaded land has unlimited resources for the introduced species.
(b) The invaded land does not have its natural predator.
(c) The population of the introduced species in the invaded land is very low.
(d) The introduced species does not face any competition in the introduced land.

INPUT-TEXT BASED QUESTIONS

Read the following paragraphs and answer the following questions.

I. Plants therefore have evolved an astonishing variety of morphological and chemical defences against herbivores. Thorns (*Acacia, Cactus*) are the most common morphological means of defence. Many plants produce and store chemicals that make the herbivore sick when they are eaten, inhibit feeding or digestion, disrupt its reproduction or even kill it. You must have seen the weed *Calotropis* growing in abandoned fields. The plant produces highly poisonous cardiac glycosides and that is why you never see any cattle or goats browsing on this plant. A wide variety of chemical substances that we extract from plants on a commercial scale (nicotine, caffeine, quinine, strychnine, opium, etc.,) are produced by them actually as defences against grazers and browsers.

1. Why you never see cattle or goats browsing on weed *Calotropis*?

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

2. 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

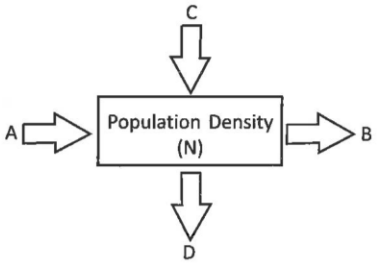
3. Which of the following is most likely to sick by consuming chemicals produced by plants?
   (a) Frog (b) Goat (c) Human (d) Pigeon
4. Plant evolve variety of morphological and chemical defences against
   (a) prey (b) predator (c) commenal (d) mutualist

II. You can see why plant-animal interactions often involve *co-evolution* of the mutualists, that is, the evolutions of the flower and its pollinator species are tightly linked with one another. 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 female wasp uses the fruit not only as an oviposition (egg-laying) site but uses the developing seeds within the fruit for nourishing its larvae.

1. The special interaction in the given para is
   (a) Mutualism (b) Commensalism (c) Amensalism (d) Parasitism
2. Similar to the above interaction is
   (a) Association of algae and fungi (b) Association of cattle egret and grazing cattle
   (c) Mycorrhizal association (d) Both (a) and (c)
3. In which of the following interactions both the partners are adversely affected?
   (a) Parasitism (b) Competition (c) Predation (d) Mutualism
4. In the given para, the relationship between fig and wasp is
   (a) One harmed, other benefitted (b) One harmed, other unaffected
   (c) Both harmed (d) Both benefitted

III. The size of a population for any species is not a static parameter. It keeps changing with time, depending on various factors including food availability, predation pressure and adverse weather. In fact, it is these changes in population density that give us some idea of what is happening to the population – whether it is flourishing or declining. Whatever might be the ultimate reasons, the density of a population in a given habitat during a given period, fluctuates due to changes in four basic processes.

1. Four basic processes determine the density of population.They are
   (i) Natality (ii) Mortality (iii) Emigration (iv) Immigration
   Select the correct option which contribute to an increase in population.
   (a) (i), (iii) and (iv) (b) (ii) and (iii) (c) (i), (ii) and (iii) (d) (i) and (iv)
2. The number of individuals of the same species that have come into the habitat from elsewhere is called
   (a) Natality (b) Mortality (c) Emigration (d) Immigration
3. In a population, X refers to Natality, Y refers to mortality, I refers to immigration and E refers to emigration. If N is the population density at time t, then its density at time t + 1 is
   (a) $N_{t+1} = N_t + [(Y + I) - (X + E)]$ (b) $N_{t+1} = N_t + [(X - I) - (Y - E)]$
   (c) $N_{t+1} = N_t + [(X + I) - (Y + E)]$ (d) $N_{t+1} = N_t + [(X + E) - (Y + I)]$
4. Look at the diagram.



   How can you define D from the diagram?
   (a) The number of deaths in the population during a given period
   (b) The number of individuals of the population who left the habitat
   (c) The number of births during a given period in the population
   (d) The number of individuals of the same species that have come into the habitat
5. When a new habitat is just being colonised, which of the following factor contribute more significantly?
   (a) Natality (b) Mortality (c) Emigration (d) Immigration

IV. It is obvious that in nature, animals, plants and microbes do not and cannot live in isolation but interact in various ways to form a biological community. Even in minimal communities, many interactive linkages exist, although all may not be readily apparent. Interspecific interactions arise from the interaction of populations of two different species. They could be beneficial, detrimental or neutral (neither harm nor benefit) to one of the species or both. Assigning a '+' sign for beneficial interaction, '-' sign for detrimental and 0 for neutral interaction.

1. If in an interaction, one species shows the sign for beneficial is beneficial and other species is detrimental, then the interaction is called

(a) Symbiosis (b) Competition (c) Predation (d) Commensalism

2. In which of the following interactions, only one species benefits and the interaction is detrimental to other species?

(a) Mutualism and symbiosis (b) Parasitism and predation

(c) Parasitism and commensalism (d) Commensalism and amensalism

3. In the table below. Which of the following interaction is given wrong?

	Species 1	Species 2	Interaction
A	+	0	Commensalism
B	+	-	Parasitism
C	-	+	Competition
D	-	0	Amensalism

4. In which of the following relationship, both species lose?

(a) Mutualism (b) Competition (c) Parasitism (d) Predation

5. Two statements are given here:

I- Mycorrihiza association in higher plants is an example of parasitism.

II- The Abingdon tortoise in Galapagos Islands become extinct due to competition.

Choose the correct option.

(a) I-True, II-False (b) I-True, II-True (c) I-False, II-True (d) I-False, II-False

ANSWERS

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

EXPLANATION

7.

Column I	Column II
(i) Temporary moving from one place to another	E. Migration
(ii) Winter sleep	A. Hibernation
(iii) A stage of suspended development	B. Diapause
(iv) Avoid summer heat	C. Aestivation
(v) One species benefit in	D. Commensalism

9. Eurythermal organisms can tolerate and thrive in a wide range of temperatures.

12. Eurythermal organisms can tolerate and thrive in a wide range of temperatures.

15. Relation of an individual to its environment is called autoecology. An individual is closest to the species hence 'b' is the correct answer.

18. A zone of transition between two communities is called ecotone.

21. The physical position and functional role of a species within the community.

23. After six generations, population = $2^6 = 64$

25. The thin zone of interaction of hydrosphere, atmosphere and troposphere; where living beings are found; is called biosphere.

28. Joel Asaph and Allen proposed this rule in 1877. According to this rule; the body shape and proportions of endotherms vary according to climatic temperature. In colder climate, the surface area is minimized to prevent heat loss and it is maximized in warm climate to promote heat loss. Endotherms in cold climate usually have small ears and small legs.

39. Tall trees form dense canopy that controls the amount of light which reaches the ground.

43. Use the formula for compound interest.

Here; P = 14 million, r = 2% and time = 10 years

Population after 10 years = 10 (102100)10=17.06 million10 (102100)10=17.06 million

45. *Orobanche* is an obligate parasitic herbaceous plant and is found in temperate climate in the Northern hemisphere. But Sandal wood is a partial root parasite.

49. A higher portion of young population means birth rate is higher than mortality and hence population will grow.

51. This is a kind of mutualism. Fungus provides water, minerals and shelter while alga prepares the food.

56. Plants do not have mechanisms to maintain internal temperatures.

59. A population has certain attributes whereas, an individual organism does not.

An individual may have births and deaths, but a population has birth rates and death rates.

Input-Text Based Answers

I.	**1.** (c)	**2.** (a)	**3.** (b)	**4.** (b)	
II.	**1.** (a)	**2.** (d)	**3.** (b)	**4.** (d)	
III.	**1.** (d)	**2.** (d)	**3.** (c)	**4.** (b)	**5.** (d)
IV.	**1.** (c)	**2.** (b)	**3.** (c)	**4.** (b)	**5.** (c)