CHAPTER – 13

ORGANISMS AND POPULATION

Our living world is fascinating diverse and amazingly complex, we can try to understand its complexity by investigating processes at various levels of biological organisation –macromolecules, cells, tissues, organs, individual organism and population, communities' ecosystems and biomes.

Ecology: The biology that explores the interactions between organisms and their physical (abiotic) environments is called ecology.

It is vital for maintaining a balance between the growth and preservation of natural environments and biotic ecosystems, the use and protection of resources, and the resolution of local, regional, and global environmental problems. it is basically concerned with four levels of biological organisation:

1. Organisms
2. Populations
3. Communities
4. Biomes

Here, we shall look at the organisms and population levels one by one:

Organisms and its Environment

Environment: The environment is the sum total of all biotic and abiotic stimuli, substances, and situations that surround and possibly impact organisms without becoming a component part of them. Regional and local variations within each biome lead to the formation of a wide variety of habitats

Physiological ecology: At this level, one seeks to understand how various organisms adapt to their environment in terms of survival and reproduction at the organism level.

On planet Earth, life exists not just in a few favourable habitats but even in extreme and harsh habitats – scorching Rajasthan desert, rain-soaked Meghalaya forests, deep ocean trenches, torrential streams, permafrost (snow laden) polar regions, high mountain tops, thermal springs, and stinking compost pits, to name a few. Even our intestine is a unique habitat for hundreds of species of microbes.The factors that lead to their establishment are temperature (intensity, duration) and changes in rainfall patterns.

Brush Up Your Understanding

Q1. Biome is:
(a) sum of ecosystems in a geographical area.
(b) sum of ecosystems of the whole earth.
(c) biotic component of an ecosystem.
(d) biotic potential of a population

S1. **(a)**

Q2. In plants of tropical rain forest, competition is mainly for.
(a) Water (b) Light
(c) Space (d) Nutrients

S2. **(b)**

Biotic components: these components make the habitat and include bacteria, parasites, predators and competitors, interaction among which continuously takes place.

Each organism has an invariably defined range of conditions that it can tolerate, diversity in the resources it utilises and a distinct functional role in the ecological system, all these together comprise its niche.

Abiotic components: the abiotic components are.

Temperature: it helps in determining a location's bio-mass. The average temperature on the land change frequently from the equator to the poles, as well as from plains to mountain peaks. Enzyme kinetics and basal metabolism, as well as physiological activities in organisms, get influenced by changes in temperature. It ranges from subzero levels in polar areas and high altitudes to >500C in tropical deserts in summer. There are, however, unique habitats such as thermal springs and deep-sea hydrothermal vents where average temperatures exceed 1000 C. It is general knowledge that mango trees do not and cannot grow in temperate countries.

Eurythermal: organisms that can tolerate a wide range of temperatures are called eurythermal. **e.g. tigers, cats**
Stenothermal: organisms that can tolerate a narrow range of temperature are called stenothermal. **E.g. fish, crocodiles**
Euryhaline: organisms that can tolerate a wide range of salinity are called euryhaline. **e.g. salmon**.

Stenohaline: organisms that can tolerate a narrow range of salinity are called stenohaline. **E.g. goldfish**

Light: it is another abiotic factor that is very important for photosynthesis in plants.

Photoperiodism: when a plant flower in the presence of sunlight then it is called as photoperiodism.

Because the sun is the source of both light and land, their availability is inextricably intertwined. The ultraviolet (UV) component of sunlight is detrimental to plants and animals.

Soil: Temperature, weathering processes affects whether the soil is transported or sedimentary, and how the soil has developed. The percolation and water retention capacity of soils are determined by soil composition, grain size, and aggregation, as well as pH, mineral content, and topography. Soil characteristics along with parameters such as pH, mineral composition and topography determine to a large extent the vegetation in any area. This in turn dictates the type of animals that can be supported. Similarly, in the aquatic environment, the sediment-characteristics often determine the type of benthic animals that can thrive there.

Responses to the abiotic factors: Many animals have developed a consistent interior environment to allow all biochemical activities and physiological functions to perform as efficiently as possible in order to maximise species' fitness. Despite a changing external environment, organisms strive to preserve the consistency of their internal environment, this is called homeostasis. There are several methods of maintaining the internal consistency of the internal environment. Such animals perform the following for homeostasis:

Regulate: Thermoregulation and osmoregulation are the sources of mammalian success in all environmental situations. Birds and animals are capable of maintaining homeostasis by physiological mechanisms, such as keeping a consistent body temperature and osmotic concentration. In summers, we sweat a lot, this lowers our body temperature. In the winter, we begin to shudder, which is a type of exercise that generates heat and elevates the body temperature.
Note: Evolutionary biologists believe that the 'success' of mammals is largely due to their ability to maintain a constant body temperature and thrive whether they live in Antarctica or in the Sahara desert.

Conform: **The osmotic concentration of bodily fluid in aquatic animals varies with the osmotic concentration of ambient water. These creatures are known as conformers.** They are unable to withstand the metabolic costs associated with maintaining a steady body temperature. Heat loss or gain is proportional to surface area. **Because tiny animals have a bigger surface area compared to their volume, they lose body heat quickly when it is cold outside, requiring them to expend a lot of energy to create body heat through metabolism. This is the primary reason why extremely tiny creatures are uncommon in the polar areas.**

Migrate: The creature moves away from the stressful adverse environment for a period of time and then returns after the stressful phase is ended. **E.g.** Every winter the famous **Keolado National Park (Bharatpur) in Rajasthan** host thousands of migratory birds coming from Siberia and other extremely cold northern regions.

Suspend: Microorganisms such as bacteria, fungus, and lower have thick-walled spores that enable them to survive in harsh settings. When favorable conditions resume, these spores germinate. Higher plants use seeds and other vegetative reproductive structures to tide them over during times of stress and to aid in dissemination. During this latent time, metabolic activity is reduced to a bare minimum. In animals, the organism, if unable to migrate, might avoid the stress by escaping in time**. E.g**

Hibernation: in such cases, organisms avoid stress by escaping in time. E.g. bears go for rest during winters.

Aestivation: organisms go into rest period to avoid summer-related problems like heat and desiccation. E.g. snails and fish.

Diapause: it is a stage of suspended development. E.g. many zooplankton species.

Brush Up Your Understanding

Q1. Soil is a.
(a) Topographic factor (b) Climatic factor
(c) Edaphic factor (d) None of the above

S1. **(c)**

Q2. Organisms that can tolerate a wide range of temperatures are called.
(a) Eurythermal (b) Euryhaline
(c) Stenothermal (d) Stenohaline

S2. (a)

Adaptations: these are morphological, behavioural and physiological changes that make organisms capable of surviving and reproducing. These adaptations include.

(i) In the absence of water, kangaroo rats in North American deserts meet their water requirements through internal fat oxidation. It can also concentrate its urine, requiring only a small amount of water to eliminate excretory materials.

(ii) Many plants have a thick cuticle that resists water loss. CAM plants widen their stomata at night to prevent water loss during photosynthesis. Some desert plants like *Opuntia,* have no leaves – they are reduced to spines– and the photosynthetic function is taken over by the flattened stems.

(iii) Colder environment mammals have shorter ears and limbs that help them in reducing heat loss. This is known as **Allen's Rule.**

(iv) Aquatic mammals such as seals in the polar regions have a thick layer of fat beneath their skin called **blubber,** which acts as an insulator and decreases heat loss.

(v) An example is altitude sickness, it is a condition that occurs at higher altitudes and involves symptoms such as nausea, exhaustion, and heart palpitations caused by a lack of oxygen and atmospheric pressure. When an individual progressively adapts to it, he/she stops feeling altitude sickness.

(vi) A variety of marine invertebrates and fish exist in temperatures that are always less than zero, and some live at tremendous depths in the ocean where pressure is extremely, this is biochemical adaptation.

(vii) Some creatures, such as desert lizards, lack physiological competence yet cope with extreme temperatures in their environment by behavioural means. They bask in the sun and absorb heat when their body temperature falls below a comfortable level, but they seek cover when the temperature rises.

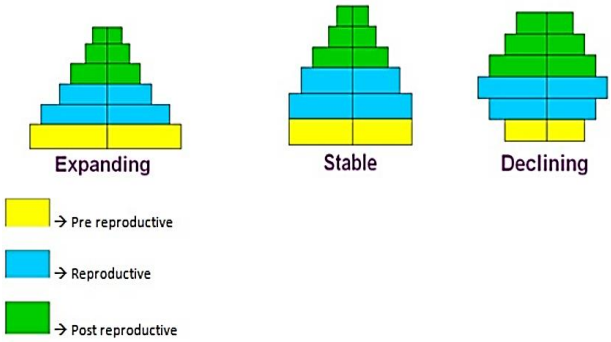
Population:

A population is found by a species which is further formed by individuals that live in a particular area and where they share and compete for resources, they breed in that particular species and expand themselves as per time.

Population attributes: various attributes of a population are:

- Birth rate: it is the per capita birth
- Death rate: it is the per capita deaths
- Sex ratio: number of males and females in a population
- Age of a population: individuals of different ages are found in a population.

Age Pyramid: When the population's age distribution is plotted, the resulting structure is known as age pyramids. The form of pyramids represents the shape of population growth status. The pyramid can be:
(a) Expanding
(b) Stable and
(c) Declining



- **Population size:** it is generally measured in terms of number. Population size, technically called population density (designated as N), need not necessarily be measured in numbers only. Although total number is generally the most appropriate measure of population density, it is in some cases either meaningless or difficult to determine.
- **Population growth:** 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. The changes throughout time and this depends on food supply, predation pressure, and meteorological conditions, some of the factors that impact population are:

(a) Natality: it refers to the number of births during a given period to the population that are added to the initial density

(b) Mortality: it is the number of deaths in the population during a given period of time

(c) Immigration: it is a number of individuals of the same species that have come into the habitat from elsewhere during the time period under consideration

(d) Emigration: what is the number of individuals of the population to left the habitat and gone during the time period under consideration.

So, if N is the population density at time t then its density at time t +1 will be:

$$N_{t+1} = N_t + [(B + I)] - [(D + E)]$$

Where: (B + I) is the number of births plus the number of immigrants.

(D + E) is the number of deaths plus number of emigrants.

Brush Up Your Understanding

Q1. Explosive growth in human population size can be attributed largely to:
(a) Declining death rates due to improved medical care.
(b) Proliferation of fast-food outlets, leading to easier access to nutrients.
(c) Increasing birth rates due to better health and fertility.
(d) Declining death rates due to declining incidence of war.

S1. (a)

Q2. In an age pyramid, the number of individuals of reproductive age is lesser than pre-reproductive but higher than post reproductive ones. The population is.
(a) Growing (b) Declining
(c) Stable (d) Can not be predicted

S2. (a)

Growth Models: they are of two types:

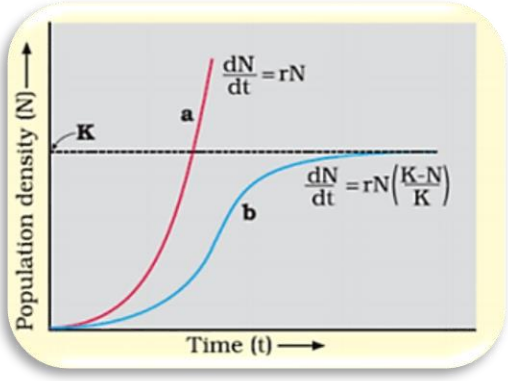
1. Exponential growth: When enough food and room are available, this type of growth takes place. When resources in the ecosystem are abundant, each species has the capacity to fully realise its natural potential for population growth. The population increases in an exponential or geometric manner.

If in a population of size N, the birth rates (not total number but per capita births) are

represented as b and death rates (again, per capita death rates) as d, then the increase or decrease in N during a unit time period t (dN/dt) will be.

dN/dt = (b-d) x N
If we consider (b-d) as r, then
dN/dt = rn

The above equation describes the exponential or geometric growth pattern of a population which when plotted on a graph comes out to be J-shaped.



Here, r: intrinsic rate of natural increase, it is very important in analyzing the effects of biotic or abiotic factors on population growth.

2. Logistic growth: There is a rivalry for food and space among individuals in a population. The organism that is the most fit lives and reproduces. This form of development begins with a leg phase, followed by acceleration and de-acceleration phases.
dN/dt = Rn (K-N/K)
Where: N is the population density at time t
r: intrinsic rate of natural increase
K: carrying capacity

Brush Up Your Understanding

Q1. A population shows a J-shaped growth curve, then it can be said that the population is showing.
(a) Exponential growth (b) Geometric growth
(c) Both (a) and (b) (d) None of the above

S1. (c)

Q2. Which of the following growth model is considered the realistic one?
(a) Exponential (b) Logistic
(c) Both (a) and (b) (d) None of the above

S2. (b)

Population Interaction: In a biological community animal, plants, and bacteria all interact with one another some are helpful, harmful, or neutral to one or both species. Various interaction that are commonly seen are:

o **Mutualism:** in this type of interaction both the species are benefitted. The most spectacular and evolutionarily fascinating examples of mutualism are found in plant-animal relationships. 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. **The wasp pollinates the fig inflorescence while searching for suitable egg-laying sites**. In return for the favour of pollination the fig offers the wasp some of its developing seeds, as food for the developing wasp larvae. Orchids show a bewildering diversity of floral patterns many of which have evolved to attract the right pollinator insect (bees and bumblebees) and ensure guaranteed pollination by it (Figure 13.8). Not all orchids offer rewards. **The Mediterranean orchid Ophrys employs 'sexual deceit' to get pollination done by a species of bee.** One petal of its flower bears an uncanny resemblance to the female of the bee in size, colour and markings. The male bee is attracted to what it perceives as a female, 'pseudocopulates' with the flower, and during that process is dusted with pollen from the flower. When this same bee 'pseudocopulates' with another

flower, it transfers pollen to it and thus, pollinates the flower. Other eaxmples include, Lichen (fungi and algae), Mycorrhizae (fungi and the roots of higher plants).

- **Amensalism:** an interaction in which one species is harmed and the other one has no effect. E.g. when we culture bacteria, colonies appear on it, and after some time we can also see fungal colonies growing on it, these fungal colonies secrete some chemical that destroys bacterial colonies while fungus has no effect.

- **Commensalism:** This is the interaction in which one species benefits and the other is neither harmed nor benefited. E.g An orchid growing as an epiphyte on a mango branch, and barnacles growing on the back of a whale benefit while neither the mango tree nor the whale derives any apparent benefit. The cattle egret and grazing cattle in close association, a sight you are most likely to catch if you live in farmed rural areas, is a classic example of commensalism. Another example is an the interaction between sea anemone that has stinging tentacles and the clown fish that lives among them. The fish gets protection from predators which stay away from the stinging tentacles. The anemone does not appear to derive any benefit by hosting the clown fish.

- **Predation:** here an animal kills another weak animal, it is an interspecific type of interaction. Predators help in the transfer of energy from plants to higher trophic levels, they help in controlling the Prey population, they also help in biological control of Agricultural pests, they maintain species diversity by reducing the intensity of competition among species that are in competition. Besides acting as 'conduits' for energy transfer across trophic levels, predators play other important roles. They keep prey populations under control. **Some plants have developed chemical defences to protect themselves from predation like, the presence of thorns in Cactus and Acacia, Calotropis produces chemicals and some plants produce nicotine, caffeine, quinine and opium to protect themselves from grazing animals**. Predators also help in maintaining species diversity in a community, by reducing the intensity of competition among competing prey species. **In the rocky intertidal communities of the American Pacific Coast the starfish Pisaster is an important predator.**

- **Parasitism:** here, one species depends on the other for food, and shelter and in such cases the host that is providing food and shelter is harmed. In accordance with their life styles, parasites evolved special adaptations such as the loss of unnecessary sense organs, presence of adhesive organs or suckers to cling on to the host, loss of digestive system and high reproductive capacity. The life cycles of parasites are often complex, involving one or two intermediate hosts or vectors to facilitate the parasitisation of its primary host. The human liver fluke (a trematode parasite) depends on two intermediate hosts (a snail and a fish) to complete its life cycle. The malarial parasite needs a vector (mosquito) to spread to other hosts. Majority of the parasites harm the host; they may reduce the survival, growth and reproduction of the host and reduce its population density

  A parasite can be an ectoparasite (lice in human head, ticks on dogs) and endoparasite (Plasmodium and liver fluke).

- Competition: it may occur between organisms of same species or unrelated species also. E.g competition between flamingo and fish for zooplanktons.

Species A	Species B	Name of Interaction
+	+	*Mutualism*
–	–	*Competition*
+	–	*Predation*
+	–	*Parasitism*
+	0	*Commensalism*
–	0	*Amensalism*

Brush Up Your Understanding

Q1. In commensalism:
(a) Population of commensally and host remains unaffected.
(b) Population of commensally may increase while that of host remains unaffected.
(c) Population of both commensally and host increases.
(d) Population of commensally increases while the population of host gradually decreases.

S1. **(b)**

Q2. Fig and Wasp show which of the following type of interaction?
(a) Parasitism
(b) Commensalism
(c) Mutualism
(d) Ammensalism

S2. **(c)**

Gauses Competition Exclusion Principle: "Two closely related species vying for the same resources cannot coexist because the one with the lower competitive advantage will be destroyed."

SUMMARY

Ecology is the branch of science that deals with the relationship between the organism and the environment. There are different levels of organization, such as organism, population, communities and biomes.

Major abiotic factors are temperature, water and light. Temperature is the most important abiotic factor that affects the organism as well as the environment. Water is another important abiotic factor. Though life originated in water some parts such as deserts have limited supply of water. So only organisms that have special adaptation can survive. The productivity and distribution of plants is also heavily dependent on water. Light is very important for photosynthesis and is another important abiotic factor. The importance of photosynthesis can be well understood in autotrophs. Regulators are organisms with the ability to maintain homeostasis. Conformers are the organisms which cannot regulate their body temperature.

Adaptation is defined as any attribute of an organism that enables the organism to survive and reproduce in its habitat. Adaptation is genetically fixed. Organisms adapt themselves according to the environment.

Population is defined as group of individuals of a species that can interbreed and produce fertile offspring. A population has certain attributes. A population may have death rate or birth rate. Increase in population per capita is known as birth rate whereas decrease in population is known as death rate. Age distribution is presented in the form of age pyramid. The shape of the pyramid reflects the status of the population. The size of the population for any species is not static. It changes according to food availability, predation pressure and adverse weather.

Exponential growth is observed when the nutrients are available in excess quantity.

When the resources are limited, then the population growth curve is logistic in nature.

There are two main interaction-interspecific interactions and intraspecific interactions. Intraspecific interaction occurs between the same species whereas interspecific interactions occurs between the different species.

IMPORTANT POINTERS

Ecology is a subject which studies the interactions among organisms and between the organism and its physical (abiotic) environment.

Temperature is the most important ecologically relevant environmental factor.

Water is another the most important factor influencing the life of organisms.

The characteristics along with parameters such as pH, mineral composition and topography determine to a large extent the vegetation in any area.

All birds and mammals, and a very few lower vertebrate and invertebrate species are capable of maintaining homeostasis. Bears undergo hibernation, snails undergo aestivation and zooplankton undergo diapause, methods by which they skip unfavorable conditions.

Opuntia, have no leaves – they are reduced to spines– and the photosynthetic function is taken over by the flattened stems, a desert adaptation.

Predators acts as 'conduits' for energy transfer across trophic levels.

Parasites that feed on the external surface of the host organism are called ectoparasites and endoparasites are those that live inside the host body at different sites.

Cuckoo and crow exhibit brood parasitism.

Ophrys employs 'sexual deceit' to get pollination done by a species of bee.

MULTIPLE CHOICE QUESTIONS

Q1. The term ecology was coined by.
(a) Ernst Haeckel
(b) Darwin
(c) von Bear
(d) Lamarck

Q2. The four levels of biological organization in Ecology are.
(a) Organisms
(b) Population
(c) Communities and Biomes
(d) All of the above

Q3. Where are the snow leopards not found in India?
(a) Himachal Pradesh
(b) Kerala
(c) Sikkim
(d) Arunachal Pradesh

Q4. Organisms that can tolerate and thrive in a wide range of temperatures are called.
(a) Stenothermal
(b) Eurythermal
(c) Cryothermal
(d) None of the above

Q5. What can be the expected salinity (in parts per thousand) of the sea?
(a) Less than 5
(b) In a range of 30-35
(c) Greater than 100
(d) Greater than 1000

Q6. Which of the following is found in the deepest waters?
(a) Brown algae
(b) Red algae
(c) Green algae
(d) All of the above

Q7. Which of the following determine the percolation and water holding capacity of soil?
(a) Soil composition
(b) Grain size
(c) Aggregation
(d) All of the above

Q8. What is homeostasis?
(a) it is the maintenance of constancy of the internal environment
(b) it is the maintenance of constancy of the external environment
(c) it is the maintenance of constancy of the internal energy
(d) it is the maintenance of constancy of the outside environment

Q9. Which of the following is a mechanism that mammals generally adopted to regulate body temperature?
(a) Eating food
(b) Shivering
(c) Walking
(d) Drinking water

Q10. Where is the Keoladeo National Park situated in India?
(a) Ajmer, Rajasthan
(b) Udaipur, Rajasthan
(c) Bharatpur, Rajasthan
(d) Jaipur, Rajasthan

Q11. Which of the following undergo aestivation during unfavorable conditions?
(a) Snail (b) Tortoise
(c) Leopard (d) Bear

Q12. Which of the following is a state of suspended development and can be seen in many zooplanktons species?
(a) Menopause
(b) Diapause
(c) Telophase
(d) Prophase

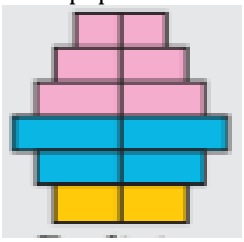
Q13. How does Kangaroo rat in the North American desert is capable of meeting all its water requirements?
(a) By its internal fat oxidation
(b) By concentrating its urine
(c) Both (a) and (b)
(d) None of the above

Q14. How do desert plants minimise water loss through transpiration?
(a) They have thick cuticle on their leaf surface
(b) They have sunken stomata
(c) Some have a special photosynthetic pathway that enables their stomata to remain close during day
(d) All of the above

Q15. In which of the following plants leaves are reduced to spines?
(a) Rose *(b) Opuntia*
(c) Bougainvillea (d) China rose

Q16. Which of the following state Allen's rule?
(a) The rule states that animals adapted to warm climates have shorter lengths and bodily appendages than animals adapted to cold climates
(b) The rule states that animals adapted to cold climates have shorter lengths and bodily appendages than animals adapted to warm climates
(c) The rule states that animals adapted to cold climates have longer lengths and bodily appendages than animals adapted to warm climates
(d) The rule states that humans adapted to cold climates have shorter lengths and bodily appendages than animals adapted to warm climates

Q17. Look at the picture given below and state what it represents about a population?



(a) Expanding population
(b) Stable population
(c) Declining population
(d) None of the above

Q18. Which of the following is carrot grass?
(a) Azadirachta indica
(b) Parthenium hysterophorus
(c) Mangifera indica
(d) *Zee mays*

Q19. Which of the following represents number of deaths in a population during a given period?
(a) Natality
(b) Mortality
(c) Immigration
(d) Emigration

Q20. Which of the following is responsible for unimpeded growth of a population?
(a) Water
(b) Food and space
(c) Light
(d) Clothes

Q21. State, what does 'r' represents in the following equation?

$$dN/dt = rN$$

(a) Rate of natural increase
(b) Rate of unnatural increase
(c) Intrinsic rate of natural increase
(d) Intrinsic rate of unnatural increase

Q22. The graph of a population showing exponential on geometric growth pattern is.
(a) S-shaped (b) J-shaped
(c) U-shaped (d) All of the above

Q23. Which of the following organisms breed only once in the lifetime?
(a) Bamboo
(b) Pacific salmon fish
(c) Rohu
(d) Both (a) and (b)

Q24. Interaction that arises between two different species is called.
(a) Intra-specific interaction
(b) Inter-specific interaction
(c) Both (a) and (b)
(d) None of the above

Q25. In which of the following types of interaction both the species lose with each other?
(a) Mutualism (b) Competition
(c) Parasitism (d) Predation

Q26. What is common among predation parasitism and commensalism?
(a) the interacting species far away from each other
(b) the interacting species live closely together
(c) the interacting species fight with each other
(d) the interacting species eat together

Q27. Biological control method adopted in agricultural pest control are based on the ability of.
(a) Mutualism (b) Predation
(c) Survival (d) All of the above

Q28. Which of the following act as predator for plants?
(a) Carnivores (b) Saprophytes
(c) Herbivores (d) All of the above

Q29. Which of the following morphological features have been adopted by *Acacia* and *cactus* so as to protect themselves from the attack of predators?
(a) Chemicals (b) Pungent smell
(c) Thorns (d) All of the above

Q30. Who gave the principle of *Competitive Exclusion*?
(a) Ernest Heckel (b) Gause
(c) Lamarck (d) None of the above

Q31. What is resource partitioning?
(a) it states that if two species compete for the same resource they could avoid competition by choosing for instance different foraging patterns
(b) it states that if two species compete for the same resource they could avoid competition by choosing for instance different sleeping patterns
(c) it states that if two species compete for the same resource they could avoid competition by choosing for instance different fighting patterns
(d) it states that if two species compete for the same resource they could avoid competition by choosing for instance different growth patterns

Q32. Which of the following serves as a host for human liver fluke?
(a) Mosquito (b) Snail
(c) Fish (d) Both (b) and (c)

Q33. Which of the following is an example of ectoparasite?
(a) Lice (b) Ticks
(c) Copepods (d) All of the above

Q34. Which of the following is an example of Brood Parasitism?
(a) Sparrow laying its egg in pigeon's nest
(b) Cuckoo laying its egg in crow's nest
(c) Parrot laying its egg in crow's nest
(d) Pigeon laying its egg in sparrow's nest

Q35. The interaction in which one species benefits and the other is neither harmed nor benefit is called.
(a) Mutualism (b) Commensalism
(c) Parasitism (d) None of the above

Q36. The interaction between a fungus and roots of higher is an example of.
(a) Parasitism (b) Commensalism
(c) Mutualism (d) Competition

Q37. Which of the following soil is rich in plant food and is good for their growth?
(a) Sandy soil (b) Clay soil
(c) Loam soil (d) Peaty soil

Q38. Which of the following soil has the lowest water holding capacity?
(a) Sandy soil (b) Loam soil
(c) Clay soil (d) Peaty soil

Q39. In which of the following case, a population is said to be declining?
(a) Natality and emigration
(b) Emigration and mortality
(c) Mortality and natality
(d) Natality and immigration

Q40. Which of the following is/are the major biomes of India?
(a) Tropical rain forest (b) Deciduous forest
(c) Desert and sea coast (d) All of the above

Q41. In which of the following growth patterns the population growth curve is sigmoid?
(a) Exponential (b) Logistic
(c) Stable (d) All of the above

Q42. Which of the following are abiotic factors?
(a) Temperature (b) Light
(c) Water (d) All of the above

Q43. Organisms that are restricted to a narrow range of temperatures are called.
(a) Cryophiles (b) Thermophiles
(c) Stenothermal (d) None of the above

Q44. Which of the following determine the percolation and water holding capacity of soil?
(a) Soil composition (b) Grain size
(c) Aggregation
(d) All of the above

Q45. What are benthic organisms?
(a) Organisms that live in shallow water
(b) Organisms that are near the depth of sea
(c) Organisms that are found at the bank of the sea
(d) Organisms found at the surface of water

Q46. Organisms that can tolerate a wide range of salinity are called.
(a) Stenohaline (b) Euryhaline
(c) Both (a) and (b) (d) None of the above

Q47. Which of the following animal undergoes hibernation during winters?
(a) Wolfs
(b) Bears
(c) Cats
(d) Monkeys

Q48. Which of the following is correct about population ecology?
(a) It links ecology to microbiology
(b) It links microbiology to population genetics
(c) It links ecology to population genetics
(d) It links population genetics to biotechnology

Q49. Which of the following influences population density?
(a) Immigration (b) Births
(c) Deaths (d) Both (b) and (c)

Q50. If a new habitat is just being colonised then which of the following will contribute more significantly to population growth?
(a) Birth rate (b) Immigration
(c) Emigration (d) Mortality

ASSERTION AND REASON

Direction: in the following questions, a statement of assertion (A) is followed by a statement of reason (R). Choose the correct option among a, b, c and d.

Q1. **Assertion (A):** Holistic approach explains the environmental interactions.
Reason (R): All the environmental factors are integrated with no limits of time and space.
(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A)
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A)
(c) Assertion (A) is true but reason(R) is false
(d) Assertion (A) is false but reason(R) is true

Q2. **Assertion (A):** There are some organisms that can maintain internal homeostasis by means of physiological process and are referred to as 'Regulators'.
Reason (R): 'Regulators' can maintain internal homeostasis only up to a limit of some stressful conditions.
(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A)
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A)
(c) Assertion (A) is true but reason(R) is false
(d) Assertion (A) is false but reason(R) is true

Q3. **Assertion (A):** Under limited resource conditions a population can show an exponential growth curve.
Reason (R): A maximum possible number of individuals can always be supported when enough resources are available.
(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A)
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A)
(c) Assertion (A) is true but reason(R) is false
(d) Assertion (A) is false but reason(R) is true

Q4. **Assertion (A):** Fig species and wasp have tight one to one relationship
Reason (R): Angiosperms and insects are co-evolved to perform a plant-pollinator interaction.
(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A)
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A)
(c) Assertion (A) is true but reason(R) is false
(d) Assertion (A) is false but reason(R) is true

TRUE AND FALSE

Q1. Each organism has an invariably defined range of conditions that it can tolerate, diversity in the resources it utilises and a distinct functional role in the ecological system, all these together comprise its niche.

Q2. A few organisms can tolerate and thrive in a wide range of temperatures they are called stenothermal.

Q3. Evolutionary biologists believe that the 'success' of mammals is largely due to their ability to maintain a constant body temperature and thrive whether they live in Antarctica or in the Sahara desert.

Q4. Under unfavourable conditions many zooplankton species in lakes and ponds are known to enter an aestivation, a stage of suspended development.

PRACTICE QUESTIONS

Q1. Which one of the following is a matching pair of certain organism(s) and the kind of association?
(a) Shark and sucker fish- commensalism
(b) Algae and fungi in lichens-mutualism
(c) Orchids growing on trees-parasitism
(d) Cuscuta (dodder) growing on other flowering plants-epiphytism

Q2. Two different species cannot live for long duration in the same niche or habitat. This law is.
(a) Allen's law
(b) Bergman's rools
(c) Competitive exclusion principal
(d) Weiseman's theory

Q3. Which of the following contributes to a decrease in population density?
(a) Immigration (b) Emigration
(c) Morality (d) Both (b) and (c)

Q4. An increase in population density occurs in which of the following case?
(a) Emigration and natality
(b) Natality and immigration
(c) Mortality and emigration
(d) Immigration and mortality

Q5. The maximum number of individuals of a population which can be supported with optimum resources for their survival is called.
(a) Biotic potential
(b) Carrying capacity
(c) Environmental resistance
(d) Potential natality

Q6. Mark the incorrect match with respect to population interaction.
(a) Ammensalism (-, 0)
(b) Predation (+, -)
(c) Commensalism (+, +)
(d) Parasitism (+, -_

Q7. According to Gause, if two species are occupying same ecological niche and competing for common resources then.
(a) Both species will eliminate each other
(b) Inferior type will eliminate the superior type of species
(c) Superior species will exclude the inferior type of species
(d) Both species will remain unaffected

Q8. Which of the following is a conduit for energy transfer across various trophic levels?
(a) Mutualism (b) Protocoperation
(c) Parasitism (d) Predation

Q9. 'Sexual deceit' is employed by.
(a) Figs (b) Orchid
(c) Yucca *(d) Pinus*

Q10. Predations performs all except.
(a) Transfer of energy
(b) Keeps the prey population under control
(c) Helps in maintaining species diversity
(d) Loss of sense organs

Q11. Crow and cuckoo are examples of which of the following?
(a) Protocoperation (b) Brood parasitism
(c) Competition (d) All of the above

Q12. Which of the following is correct about population?
(a) A group of organisms of one species occupying a defined area
(b) A group of organism of different species occupying a defined area
(c) A group of organisms of different species occupying different geographical area
(d) A group of sexually isolated organism occupying a defined area

Q13. Ecology is basically concerned with how many basic levels of organisation?
(a) 2 (b) 3
(c) 4 (d) 8

Q14. Permafrost condition is a characteristic feature of.
(a) Hot desert biome
(b) Cold desert biome
(c) Savanna biome
(d) Chaparral biome

Q15. In incorrect match among the following is.
(a) Soil texture—topographic factor
(b) Soil factor – Edaphic factor
(c) Wind – Climatic factor
(d) Slope of mountain – Physiographic factor

Q16. Which of the following is incorrect with respect to tropical rain forest?
(a) Permafrost (b) Drip tips
(c) Epiphytes (d) Woody climber

Q17. The organisms that are found in boiling thermal springs are.
(a) Fungi (b) Protists
(c) Archaebacteria (d) Actinomycetes

Q18. A habitat is constituted by which of the following?
(a) Predators and pathogens
(b) Biotic and abiotic factors
(c) Climatic and edaphic factors
(d) Topographic, climatic and edaphic factors

Q19. The two most important factors influencing the life of organisms are.
(a) Soil, temperature
(b) Light, water
(c) Water, temperature
(d) Soil, light

Q20. Smaller animals tend to loose body heat very fast as compared to larger animals because they have.
(a) Higher surface to volume ratio
(b) Lower surface to volume ratio
(c) Equal values of surface and volume
(d) Very low BMR

Q21. 'Resource partitioning' is an important mechanism which promotes.
(a) Competitive release
(b) Co-existence
(c) Competitive exclusion
(d) Antibiosis

Q22. Camouflage is an important mechanism where.
(a) Predators are never cryptically coloured for easy capturing of their prey
(b) Prey species are cryptically coloured to avoid being detected easily by the predator
(c) Prey produces some poisonous chemicals in their surroundings to protect themselves from predators
(d) Predators evolved some physiological adaptations to reach to the prey present in some harsh habitats

Q23. A j-shaped growth curve depicts.
(a) Exponential growth when conditions are limited
(b) Exponential growth when conditions are unlimited
(c) Logistics growth when conditions are limited
(d) Logistics growth when conditions are unlimited

Q24. The correct statement among the following is.
(a) Two species within a given community can have exactly the same niche
(b) Two species within a given community cannot have exactly the same niche
(c) Two species can live permanently together
(d) Both (b) and (c)

Q25. Rise in temperature and air humidity can be observed from.
(a) Equator towards polar region
(b) Poles to the equator region during latitudinal transition
(c) Plains to mountains top during altitudinal movement
(d) None of the above

Q26. The process that maintains constancy of internal body temperature of organism despite varying external environmental conditions is called.
(a) Homeostasis (b) Epistatis
(c) Heterosis (d) Antibiosis

Q27. Altitude sickness is managed by the body by.
(a) Decreasing RBC production
(b) Increasing fat oxidation
(c) Decreasing binding capacity of Haemoglobin
(d) Decreasing breathing rate

Q28. Competition for food, light and space is most severe between two.
(a) Distantly related species growing in different habitat
(b) Distantly related species growing in the same habitat
(c) Closely related species growing in different habitat
(d) Closely related species in the same area

Q29. Which among the following plant shows a very close relationship with a species of moth where none of the two can complete its life cycle without the other?
(a) Hydrilla *(b) Yucca*
(c) Viola (d) Banana

Q30. Natality refers to the.
(a) Birth rate
(b) Death rate
(c) Number of individuals entering a habitat
(d) Number of individuals leaving a habitat

ASSERTION AND REASON

Direction: in the following questions, a statement of assertion (A) is followed by a statement of reason (R). Choose the correct option among a, b, c and d.

Q1. **Assertion (A):** Shivering is an adaptation for low temperature.
Reason (R): Shivering warms up the body
(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A)
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A)
(c) Assertion (A) is true but reason(R) is false
(d) Assertion (A) is false but reason(R) is true

Q2. **Assertion (A):** The interaction between sea anemone and clown fish is commensalism.
Reason (R): The fish gets protection from predators but anemone does not appear to derives any benefit.
(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A)
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A)
(c) Assertion (A) is true but reason(R) is false
(d) Assertion (A) is false but reason(R) is true

Q3. **Assertion (A):** Small animals have a larger surface area relative to their volume, they tend to lose body heat very fast when it is cold outside.
Reason (R): In such a case they have to expend small amount of energy to generate body heat through metabolism.
(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A)
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A)
(c) Assertion (A) is true but reason(R) is false
(d) Assertion (A) is false but reason(R) is true

Q4. **Assertion (A):** Some desert plants have no leaves, they are reduced to spines and the photosynthetic function is taken over by the flattened stems.
Reason (R): An example of desert plant is *Opuntia.*
(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A)
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A)
(c) Assertion (A) is true but reason(R) is false
(d) Assertion (A) is false but reason(R) is true

SOLUTIONS MULTIPLE CHOICE

S1. **(a)** Ernst Haeckel was a German zoologist who applied the term 'oekologie' to the relation of animals both towards their organic as well as the inorganic environment.

S2. **(d)** organisms, populations, communities, and biomes are the four levels of biological organization and ecology

S3. **(b)** snow leopards prefer steep rugged terrain with rocky outcrops and ribbons, they are generally found in the mountainous regions of central and southern Asia, in India they are found in Jammu Kashmir, Himachal Pradesh, Uttarakhand Sikkim, and Arunachal Pradesh.

S4. **(b)** eurythermal are species with a wide tolerance range, in this case for temperature because organisms must be able to survive in an environment in order to persist in it. Most species from a habitat with moderately to highly variable temperatures are eurytherms.

S5. **(b)** salinity is the saltiness or amount of salt that is dissolved in a water body, it is generally measured in parts per thousand (ppt.) and is an important factor in determining many aspects of chemistry of natural waters and of biological processes that are taking place inside it

S6. **(b)** Of the solar radiation only a part of it reaches the deepest waters, red algae due to the presence of phycobilin and phycoerythrin pigment is able to absorb the blue light and uses it for photosynthesis thus red algae is found at the base of the ocean as they can manufacture the food by the blue light

S7. **(d)** soil composition, grain size, and aggregation determine the percolation and water holding capacity of soil, these characteristics along with other parameters like pH mineral, composition, and topography determine to a large extent the vegetation of a particular area.

S8. (a) homeostasis is a state of steady internal physical and chemical conditions maintained by living systems.

S9. (b) in winters when the temperature is much lower than 37 degrees, we start to shiver, it is a kind of exercise that produces heat and raises the body temperature.

S10. (c) the national park in Bharatpur Rajasthan hosts thousands of migratory birds coming from Siberia and other extremely cold Northern regions.

S11. (a) aestivation is a state of animal dormancy and similar to hibernation, although it takes place in summer rather than in winter.

S12. (b) many animal species undergo long sleep during the unfavourable condition. Diapause is a condition of suspended development that can be seen in many zooplankton species in lakes and ponds.

S13. (c) adaptation is any attribute of the organism that enables it to survive and reproduce in its habitat. Many adaptations have evolved over a long revolutionary time and are genetically fixed, Kangaroo rat has also adapted itself according to the desert conditions.

S14. (d) just like the animal's plants have also evolved and developed ways by which they can survive in some of the most unfavourable conditions, presence of thick waxy cuticle on the leaves surfaces, sunken stomata are some of the conditions by which plants reduce loss of water through transpiration.

S15. (b) in *Opuntia*, leaves are reduced to spines and the photosynthetic function is taken over by the flattened stem.

S16. (b) the rule is basically for organisms living in cold regions.

S17. (c) the picture is of an age pyramid that shows the distribution of people in a given population, the picture represents a declining population

S18. (b) carrot grass is also known as congress grass or *gajar ghas.*

S19. (b) mortality along with natality, immigration and emigration effect the density of a population.

S20. (b) when resources in a habitat are unlimited, the population flourishes to maximum.

S21. (c) 'r' is a very important parameter chosen for assessing the impact of any biotic or abiotic factor on population growth.

S22. (b) any species growing exponentially under unlimited resource condition can reach enormous population densities in a short time and the graph obtained will be J-shaped.

S23. (d) under a particular set of selection pressures, organisms evolve towards the most efficient reproductive strategy, some reproduce only once in their lifetime like bamboo and Pacific Salman fish while others breed many times during the lifetime.

S24. (b) inter specific interaction can be beneficial detrimental or neutral to one of the species or both

S25. (b) competition is a condition where a species has to compete for a particular thing for their survival.

S26. (b) in these interactions all the species are found very close to each other

S27. (b) biological control method for agricultural pest control are based on the ability of the predator to regulate prey populations

S28. (c) for plants herbivores are the predator's, plants cannot run away from their predators so they have evolved astonishing variety of morphological and chemical defences against herbivores.

S29. (c) presence of thorns keeps away the animals from the plants

S30. (b) Gause gave the principle of *Competitive Exclusion* that states that two closely related species competing for the same resources cannot co-exist indefinitely and the competitively inferior one will be eliminated eventually.

S31. (a) Mac Arthur in the same context showed that five closely related species of warblers living on the same tree were able to avoid competition and co-exist due to behavioural differences in there foraging activities.

S32. (d) parasites have also evolved special adaptations so that they can survive easily, for example loss of unnecessary sense organs, presence of adhesive organs to cling onto the host, loss of digestive system and highly reproductive capacity and completing life in more than one host are some of the adaptations.

S33. (d) parasites that feed on the external surface of the host organism are called ectoparasites.

S34. (b) during the course of evolution, the eggs of the parasitic bird have evolved so much that they have started resembling to the host egg in size and colour so as to reduce the chances of host detecting the foreign eggs and ejecting them from the nest.

S35. (b) examples of commensalism include, an orchid growing as an epiphyte on a mango branch and barnacles growing on the back of a whale benefit while neither the mango tree nor the whale derives any apparent benefit from the other.

S36. (c) in this association the fungi helps the plant in absorption of essential nutrients from the soil and the plant in turn provide the fungi with energy yielding carbohydrates

S37. (b) clay soil has the smallest particles composition and it has fair water storage capacity, only very little air can pass through its spaces because of the tiny size of its particles and also due to its tendency to settle together, it is better for plant growth.

S38. (a) sandy soil has lowest water holding capacity, the soil is very light in weight, the particles are bigger in size. The soil is well aerated.

S39. (b) mortality is the number of deaths in the population during a given period and emigration is the number of individuals of the population who left the habitat and gone elsewhere during the time period under consideration. In both the cases, number of people are reducing so the population is declining.

S40. (d) biomes are very important part of an ecosystem, regional and local variations within each biome lead to the formation of wide variety of habitats.

S41. (b) for logistic growth pattern, the growth curve is sigmoid. Since resources for growth for most animal populations are finite and become limiting sooner or after the, Logistic growth model is considered more realistic one.

S42. (d) abiotic factor is a non-living part of an ecosystem that helps in shaping the environment.

S43. (c) stenothermal organisms are able to survive over only a narrow range of temperatures.

S44. (d) Along with these characteristics, pH, mineral composition and topography affect the vegetation of an area.

S45. (b) Benthic communities are complex and include a wide range of animals, plants and bacteria from all levels of the food web e.g clams, oysters mussels, etc.

S46. (c) the organisms that can adapt to a wide range of salinity are called euryhaline. e.g green crab

S47. (b) hibernation is winter sleep; it is a function to conserve energy when sufficient food is not available. It can last for days, weeks or months depending on the species temperature, time of the year and the individuals body condition.

S48. (c) the study of processes that affect the distribution and abundance of animal and plant populations is called population ecology.

S49. (d) Births and deaths are two most important factors that influence the population density immigration and emigration assume importance only under special conditions.

S50. (b) in a newly colonised area, people coming from outside will affect population growth to larger extent that the number of birth rates.

ASSERTION AND REASON

S1. (c) All environmental factors are limited by time and space.

S2. (c) some organisms like regulators are capable of homeostasis in the face of changing external environment.

S3. (a)

S4. (a) The wasp pollinates the fig inflorescence while searching for suitable egg-laying sites. In return for the favour of pollination the fig offers the wasp some of its developing seeds, as food for the developing wasp larvae.

TRUE AND FALSE

S1. (True)

S2. (False) such animals are called eurythermal.

S3. (True)

S4. (False) Under unfavourable conditions many zooplankton species in lakes and ponds are known to enter diapause, a stage of suspended development.

PRACTICE SOLUTIONS

S1. (b) Lichens are symbiotic association between an algal component and a fungal component. The algal component prouides food while fungal component prouides moisture, minerals and prevents the algal component from dessication.

S2. (c)

S3. (d) Morality is the number of deaths and emigration is moving out of certain population from a given area, both will lead to decrease in population.

S4. (d) Natality and immigration will lead to increase in population density.

S5. **(b)** In nature, a given habitat has resources to support a certain number of individuals of a population, beyond which no further growth is possible. This limit is called as nature's carrying capacity(K) for that species in that habitat.

S6. **(c)** commensalism shows(+, 0) interaction.

S7. **(c)** In ecology, the competitive exclusion principle, sometimes referred to as Gause's law of competitive exclusion or just Gause's law is a proposition that states that two species competing for the same resource cannot coexist at constant population values if other ecological factors remain constant. When two competing life forms attempt to occupy the same niche, only one outcome is possible: One life form will drive out the other.

S8. **(d)** Predators are conduits for the transfer of energy through the trophic levels.

S9. **(b)** The Mediterranean orchid Ophrys employs 'sexual deceit' to get pollination done by a species of bee.

S10. **(d)** predation keeps the population of preys under control

S11. **(b)** Brood parasitism in birds is a fascinating example of parasitism in which the parasitic bird lays its eggs in the nest of its host and lets the host incubate them.

S12. **(a)**

S13. **(c)** the four levels of organisation in ecology are organism, population, ecosystem and biosphere.

S14. **(b)** permafrost is a feature of snow laden, polar regions.

S15. **(a)** topographic factors include latitude, altitude, steepness of mountains etc.

S16. **(a)** permafrost is the feature of polar regions.

S17. **(c)** there are microbes(archaebacteria) that flourish in hot springs and deep sea hydrothermal vents where temperatures far exceed 1000 degree C.

S18. **(b)** A habitat is a place where plants and animals normally live. Some habitats have lots of plants and animals, some do not. Some habitats are near water, some are on top of mountains. Each habitat has a different mixture of **species** living there.

S19. **(c)**

S20. **(a)** Smaller animals tend to lose body heat very fast as compared to larger animals because they have higher surface to volume ratio.

S21. **(b)** If two species compete for the same resource, they could avoid competition by choosing, for instance, different times for feeding or different foraging patterns. It is resource portioning.

S22. **(b)**

S23. **(b)** The J-shaped of growth curve for the population growth in a species indicates the exponential form of growth. There is rapid increase in the growth rate due to the favorable factors.

S24. **(d)**

S25. **(b)**

S26. **(a)** Some organisms are able to maintain homeostasis by physiological(sometimes behavioural also) means which ensures constant body temperature, constant osmotic concentration, etc.

S27. **(c)** During altitude sickness, the body compensates low oxygen availability by increasing red blood cell production, decreasing the binding affinity of hemoglobin and by increasing breathing rate.

S28. **(d)** Competition of light, nutrients and space is most severe between closely related organisms growing in the same area/niche, due to overproduction of population in the same area/ niche.

S29. **(b)**

S30. **(a)**

ASSERTION AND REASON

S1. **(a)** In winter when the temperature is much lower than 370C, we start to shiver, a kind of exercise which produces heat and raises the body temperature.

S2. **(a)**

S3. **(c)** in such a case they have to expend much energy to generate body heat through metabolism.

S4. **(a)**