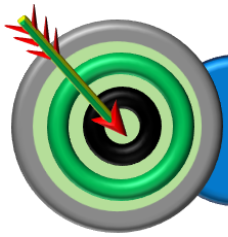
Chapter
11

Organisms and Populations



OBJECTIVES

- INTRODUCTION
- POPULATIONS
- POPULATION INTERACTION

INTRODUCTION

The living world is **diverse and complex**, and it can be study its intricacies by examining biological processes at different levels of organization—ranging from macromolecules to biomes. Scientific inquiry involves two types of questions:

"How" questions seek to understand the mechanisms behind biological processes (e.g., how a bird sings).

"Why" questions explore the significance of these processes (e.g., why a bird sings during the breeding season).

Observing nature with curiosity leads to fascinating questions about plant and animal behavior, such as why night-blooming flowers are white or how bees locate nectar.

Ecology studies the interactions between organisms and their environment. It is explored at four levels: organisms, populations, communities, and biomes.

11.1 POPULATIONS

A population is a group of individuals of the same species living in a specific geographical area, sharing or competing for resources, and potentially interbreeding. Even individuals reproducing asexually are considered part of a population.

Examples of populations:

- Cormorants in a wetland
- Rats in an abandoned house
- Teakwood trees in a forest
- Bacteria in a culture plate
- Lotus plants in a pond

While **individual organisms** adapt to environmental changes, **natural selection** acts at the population level, shaping traits over time. **Population ecology** is crucial as it connects ecology with population genetics and evolution, helping us understand species survival and adaptation.

11.1.1 Population Attributes

A **population** has characteristics that an **individual organism** does not. These include:

(i) Birth Rates and Death Rates

- A population's birth rate and death rate refer to **per capita births and deaths**.
- **Formula** for **birth rate:**

$$Birth\ rate = \frac{Number\ of\ new\ individuals\ added}{Initial\ population\ size}$$

Example: If a pond had **20 lotus plants** last year and **8 new plants** were added, the birth rate is:

$$\frac{8}{20} = 0.4\ offspring\ per\ lotus\ per\ year$$

- **Formula for death rate:**

$$Death\ rate = \frac{Number\ of\ individuals\ that\ died}{Initial\ population\ size}$$

Example: If **4 individuals** in a population of **40 fruit flies** died in a week:

$$\frac{4}{40} = 0.1\ individuals\ per\ fruit\ fly\ per\ week$$

(ii) Sex Ratio

- Represents the proportion of males and females in a population.
- Example: **60% females and 40% males** in a population.

(iii) Age Pyramid

- Populations consist of individuals of different ages.
- The **age pyramid** represents the age distribution (percentage of individuals in each age group).
- Three types of age pyramids:
  - **Expanding (Growing) Population** – Broad base, high birth rate.

- **Stable Population** – Uniform width, equal birth and death rates.
- **Declining Population** – Narrow base, lower birth rate than death rate.

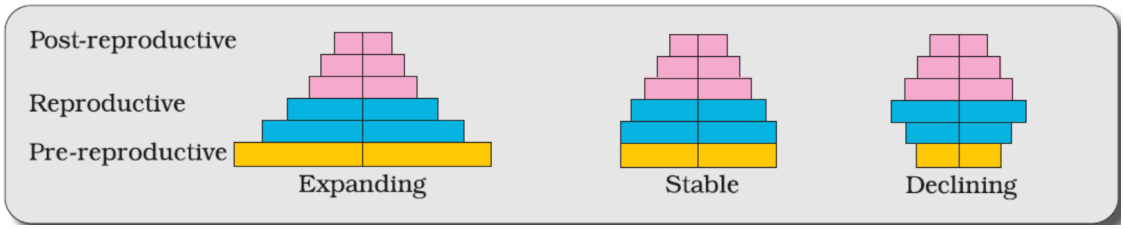


Fig.: Representation of age pyramids for human population

Population Size and Density

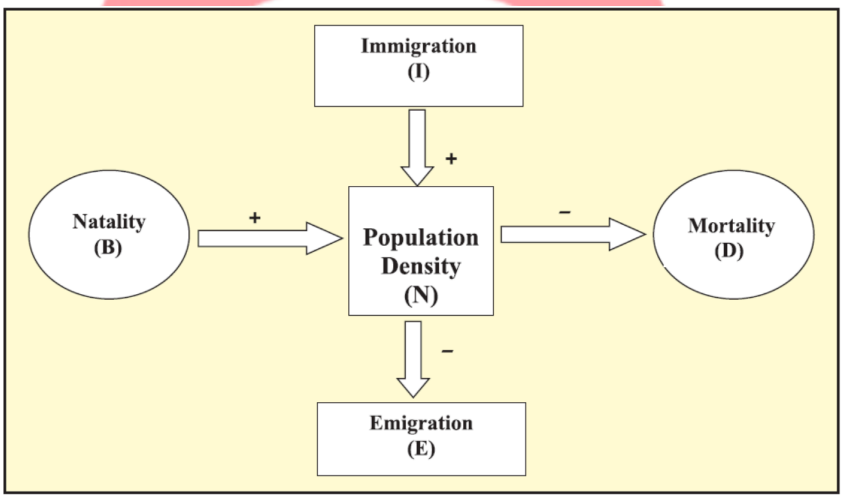
- The **size of a population** indicates its status in the habitat.
- **Factors** affecting population size: **competition, predation, environmental conditions, human intervention.**
- **Population density (N)** is the number of individuals per unit area.
- In some cases, population density is measured in:
  - **Total count** (e.g., number of individuals in a forest).
  - **Percentage cover or biomass** (e.g., in plants like banyan trees, which have a large canopy).
  - **Relative density** (e.g., number of fish caught per trap in a lake).
- **Indirect estimation of population size** includes:
  - **Tiger census using pug marks and fecal pellets** in national parks.

11.1.2 Population Growth

- Population size is **not static**; it changes due to various factors:
  - **Food availability**
  - **Predation pressure**
  - **Environmental factors** (e.g., climate changes)

Four Factors Affecting Population Density

1. **Natality (B)** – Number of births added to the population.
2. **Mortality (D)** – Number of deaths in a given period.
3. **Immigration (I)** – Individuals entering the habitat from other regions.
4. **Emigration (E)** – Individuals leaving the habitat for other regions.



Population Density Formula

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

Where:

N_t = Initial population density at time **t**

N_{t+1} = Population density at time **t+1**

B = Births I = Immigration

D = Deaths E = Emigration

Interpretation of Population Growth

- **Population increases if**: (B+I) > (D+E)
- **Population decreases if**: (B+I) < (D+E)
- **Births and deaths** are the primary factors influencing population size.
- **Immigration is crucial in colonizing new habitats** (e.g., newly introduced species).

11.1.3 Growth Models:

The growth of a population over time follows specific and predictable patterns. Observing population trends in nature can provide insights into controlling human population growth. While human populations often grow rapidly, animal populations in nature exhibit **natural restraints** due to factors like food availability, predation, and environmental conditions. Studying these patterns can help us understand sustainable population control mechanisms.

(i) Exponential growth:

- **Population growth** is **influenced** by **resource availability** (food, space, etc.).
- When resources are **unlimited**, a species can **fully express its reproductive potential** and grow without restriction.
- This **type** of growth is known as **exponential or geometric growth**.

Mathematical Representation:

- Population size **N** changes over time **t** based on birth rate (**b**) and death rate (**d**).
- The equation for population growth:

$$\frac{dN}{dt} = (b - d) \times N$$

- Let **r = (b - d)**, where **r** is the **intrinsic rate of natural increase**.
- The equation simplifies to:

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

- Intrinsic **rate of natural increase (r):**
  - A key parameter to measure how fast a population grows.
  - Affected by **biotic (living) and abiotic (non-living) factors**.

Significance of 'r' (Intrinsic Rate of Natural Increase)

- It represents the **rate at which a population grows in ideal conditions**.
- Different species have different **r values**:
  - **Norway rat**: **0.015**
  - **Flour beetle**: **0.12**
  - **Human population (India, 1981)**: **0.0205**
- The current **r value** can be determined using **birth rate and death rate** data.

Exponential Growth Curve

- The **exponential growth equation** in its integral form:

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

Where:

- N_t = Population density at time **t**

- N_0 = Initial population density
- r = Intrinsic rate of natural increase
- e = Base of natural logarithms (**2.71828**)
- **Graphical Representation:**
  - Exponential growth produces a **J-shaped curve** when plotted as **population size vs. time**.
  - The population grows **slowly at first**, then increases **rapidly** as time progresses.

Characteristics of Exponential Growth

- Occurs when **resources are unlimited** (food, space, etc.).
- Population size can **increase dramatically** in a short period.
- Common in **invasive species** or **newly introduced populations** in a favorable environment.

Real-World Examples

1. **Bacteria in a culture medium**
   - In favorable conditions, bacteria reproduce **rapidly**, doubling their number every few hours.
2. **Algal blooms in nutrient-rich water bodies**
   - Under ideal conditions, algae grow **exponentially**, covering entire lakes in days.
3. **Human population growth (historically)**
   - The human population grew exponentially after the **Industrial Revolution** due to **better healthcare, agriculture, and sanitation**.

Limitations of Exponential Growth

- **Not sustainable in real-world conditions.**
- Eventually, **resources become limited**, leading to a **slowdown in growth**.
- Leads to a shift towards **logistic growth**, where population stabilizes at the **carrying capacity (K)** of the environment.

Conclusion

- **Exponential growth occurs in ideal, unlimited conditions** and follows a **J-shaped curve**.
- The intrinsic growth rate **(r)** determines how fast a population increases.
- While some species exhibit this growth temporarily, **real populations eventually face resource limitations** and shift to a more **stable growth pattern**.

(ii) Logistic growth:

Logistic growth describes how a population grows in an environment with **limited resources**. It follows an **S-shaped (sigmoid) curve** and is represented by the **Verhulst-Pearl Logistic Growth Equation**:

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

where:
dN/dt = rate of population growth
r = intrinsic growth rate
N = population size
K = carrying capacity (maximum population the environment can support)

Key Phases of Logistic Growth

1. **Lag Phase** – Slow population increase as individuals adjust to the environment.
2. **Exponential Phase** – Rapid growth due to abundant resources.
3. **Deceleration Phase** – Growth slows as resources become limited.
4. **Stationary Phase** – Population stabilizes at the carrying capacity (**K**) due to resource limitations and environmental resistance.

Significance of Logistic Growth

- More **realistic** than exponential growth, as resources are **finite**.
- Seen in **natural populations** like bacteria, animals, and plants.
- Helps in **conservation biology** and **resource management**.

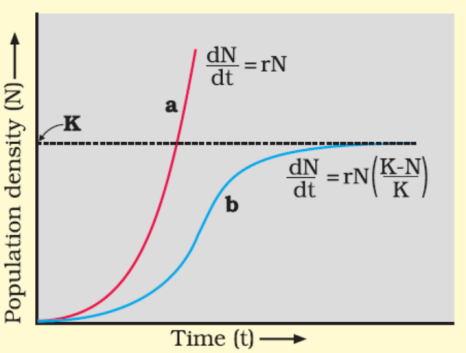


Fig.: Population growth curve **a** when responses are not limiting the growth, plot is exponential, **b** when responses are limiting the growth, plot is logistic, **K** is carrying capacity

Since resources for growth for most animal populations are finite and become limiting sooner or later, the logistic growth model is considered a more realistic one.

11.1.3 Life History Variation

Populations evolve to maximize their **reproductive fitness (Darwinian fitness)** in response to selection pressures in their habitat. Organisms adopt different reproductive strategies for survival:

1. **Breeding Frequency:**
   - Some organisms breed only once in their lifetime (e.g., **Pacific salmon, bamboo**).
   - Others breed multiple times (e.g., **most birds, mammals**).
2. **Offspring Quantity and Size:**
   - Some species produce **many small-sized offspring** (e.g., **oysters, pelagic fishes**).
   - Others produce **few large-sized offspring** (e.g., **birds, mammals**).

The evolution of these **life history traits** is influenced by both **abiotic (non-living)** and **biotic (living)** factors in the habitat. Understanding these adaptations is a key area of ecological research.

TOPIC CENTRIC EXERCISE -01

Q1. Which population attribute measures the number of individuals per unit area?
(a) Birth rate (b) Death rate
(c) Age distribution (d) Population density

Q2. What does the age pyramid of a declining population look like?
(a) Broad base and narrow top (b) Uniform width throughout
(c) Narrow base with a wider top (d) Inverted U-shape

Q3. What happens when (B+I) < (D+E) in a population?
(a) The population increases (b) The population decreases
(c) The population remains stable (d) The population reaches carrying capacity

Q4. What does 'r' represent in population growth equations?
(a) Carrying capacity
(b) Birth and death rate difference (intrinsic rate of natural increase)
(c) Total population size
(d) Percentage of offspring surviving

Q5. Which of the following is an example of an organism that reproduces only once in its lifetime?
(a) Humans (b) Bamboo
(c) Rats (d) Deer

11.2 POPULATION INTERACTIONS

1. **No Species Can Exist in Isolation**
   - There is no natural habitat on Earth inhabited by a single species.
   - Every species requires interactions with at least one other species for survival.

- Example: Even autotrophic plants require:
- Soil microbes to recycle nutrients.
- Pollinators for reproduction.
- Organisms interact in various ways to form **biological communities**.
- Even in minimal communities, complex linkages exist, though some may not be obvious.

2. Interspecific Interactions

Definition:

- Interactions between **populations of different species** in an ecosystem. These interactions can be:
  - **Beneficial (+)**
  - **Detrimental (-)**
  - **Neutral (0)**

Interaction Type	Species A	Species B	Example
Mutualism	+	+	Lichen (fungus & algae), Pollination
Competition	-	-	Lions and hyenas competing for prey
Parasitism	+	-	Tapeworm in the human intestine
Predation	+	-	Lion hunting a deer
Commensalism	+	0	Orchid growing on a tree
Amensalism	-	0	Penicillium fungus killing bacteria

3. Explanation of Interspecific Interactions

A. Mutualism (+, +)

Both species benefit from the interaction.

B. Competition (-, -)

Both species suffer due to competition for limited resources.

C. Parasitism (+, -)

One species (parasite) benefits while the other (host) is harmed.

D. Predation (+, -)

One species (predator) benefits by killing and consuming the other (prey).

E. Commensalism (+, 0)

One species benefits, while the other remains unaffected.

F. Amensalism (-, 0)

One species is harmed, while the other remains unaffected.

4. Shared Characteristics of Certain Interactions

- Predation**, parasitism, and commensalism** share a common feature:
- The interacting species **live closely together** (often in prolonged interactions).
- These **relationships** shape ecosystems and drive **evolutionary adaptations**.

Conclusion

- No species **exists** alone; all organisms interact to form complex ecological relationships.
- These **interactions** determine survival, population dynamics, and biodiversity.
- **Understanding interspecific interactions** helps in conservation, ecosystem management, and evolutionary studies.

(i) Predation:

Predation is an interaction where one species (predator) kills and feeds on another (prey). Predators facilitate energy transfer across trophic levels and regulate prey populations to prevent ecosystem instability. Herbivores, such as sparrows eating seeds, are also considered predators in a broad ecological sense.

Impact of Predators:

- Predators prevent prey species from overpopulating and destabilizing ecosystems.
- Invasive species spread rapidly in new environments due to the absence of natural predators, as seen with the prickly pear cactus in Australia, which was controlled by introducing a cactus-feeding moth.
- Biological pest control relies on predators to manage pest populations.
- Predators enhance species diversity by limiting competition among prey species. In an experiment on the American Pacific Coast, the removal of starfish (*Pisaster*) led to the extinction of over 10 invertebrate species due to increased competition.
- Overexploitation by predators can lead to prey extinction, followed by the predator's decline due to a lack of food. Hence, predators in nature are "prudent."

Defense Mechanisms Against Predation

1. **Camouflage (Cryptic Coloration):** Some insects and frogs blend with their surroundings to avoid detection.
2. **Toxicity:** Some prey species are poisonous, deterring predators. For example, the Monarch butterfly stores toxic chemicals from its caterpillar stage, making it distasteful to birds.

Plant Defenses Against Herbivores

- **Morphological Defense:** Thorns in *Acacia* and *Cactus* deter herbivores.
- **Chemical Defense:** Plants produce toxic compounds to repel herbivores. Examples include nicotine, caffeine, quinine, strychnine, and opium. The weed *Calotropis* produces poisonous cardiac glycosides that harm herbivores by disrupting digestion and reproduction.

These natural adaptations help maintain ecological balance by regulating predator-prey interactions.

(ii) Competition:

Definition: Competition is an interaction where the fitness (*r* value) of one species is reduced due to the presence of another species. Both species involved are negatively affected.

Types of Competition:

1. **Intraspecific Competition:**
   - Occurs within the same species for resources like food, space, or mates.
   - Example: Two lions fighting for territory.
   - Leads to natural selection and population regulation.
2. **Interspecific Competition:**
   - Occurs between different species competing for similar resources.
   - Example: Flamingoes and fish competing for zooplankton in South American lakes.
   - Can lead to competitive exclusion or adaptation.

Difference Between Intraspecific and Interspecific Competition

Feature	Intraspecific Competition (Within species)	Interspecific Competition (Between species)
Definition	Competition among individuals of the same species for resources (food, water, space, mates, etc.).	Competition between individuals of different species for similar resources in an ecosystem.
Example	Two lions fighting for territory.	Lions and hyenas competing for the same prey.
Resources	Usually identical because all individuals need the same things.	Similar but not identical; species may have overlapping needs.
Impact on Population	Can lead to natural selection and regulation of population size.	May lead to competitive exclusion or resource partitioning.
Outcome	Stronger individuals outcompete weaker ones within the species.	One species may dominate, forcing the other to adapt, migrate, or decline.

3. **Interference Competition:**
    - One species reduces the feeding efficiency of another, even when resources are abundant.

Evidence of Competition:

- Competitive **Exclusion:**
- Gause's Principle states that two closely related species competing for the same resource cannot coexist indefinitely; the inferior species is eventually eliminated.
- Example: The Abingdon tortoise in the Galápagos Islands became extinct after goats were introduced, as goats were more efficient browsers.
- Competitive **Release:**
- When a superior competitor is removed, a previously restricted species expands its range.
- Example: Connell's experiment in Scotland showed that Balanus barnacles dominated the intertidal zone, excluding Chathamalus.

Mechanisms for Coexistence:

- Resource **Partitioning:**
- Instead of eliminating one species, competition can drive adaptations for coexistence.
- Example: MacArthur's study on warblers found that five species coexisted on the same tree by varying their feeding times and foraging behaviors.

Thus, while competition can lead to exclusion, species often develop strategies to coexist and minimize direct competition.

(iii) Parasitism:

Definition: Parasitism is a relationship where one organism (parasite) lives on or inside another organism (host), deriving benefits at the host's expense.

Characteristics of Parasites

- Free lodging and meals lead to the evolution of parasitism across many taxonomic groups (plants, animals, etc.).
- Parasites and hosts **co-evolve**:
- If the host evolves resistance, the parasite evolves counter-strategies.

Adaptations of Parasites

- Loss of unnecessary sense organs.
- Presence of suckers or adhesive organs for attachment.
- Reduced or lost digestive system (in some endoparasites).
- High reproductive capacity.

Types of Parasites

1. **Ectoparasites (External parasites)**
    - Live on the surface of the host's body.
    - Examples:
    - Lice on humans.
    - Ticks on dogs.
    - Marine fish infested with parasitic copepods.
    - Cuscuta (Dodder plant) – A parasitic plant that has lost its chlorophyll and depends on the host plant for nutrients.

Note: The female mosquito is not considered a parasite because it only temporarily feeds on blood for reproduction.

2. **Endoparasites (Internal parasites)**
    - Live inside the host's body, in organs such as the liver, lungs, kidneys, and blood.
    - Highly specialized with simplified structures and complex life cycles.
    - Examples:
    - Human liver fluke requires two intermediate hosts (a snail and a fish) to complete its life cycle.

- Malarial parasite (Plasmodium) spreads via a mosquito vector.

3. **Brood Parasitism (In birds)**
   - A parasitic bird lays eggs in the nest of a host bird, which incubates them unknowingly.
   - Over time, the parasitic bird's eggs evolved to resemble the host's eggs in size and color to avoid detection.
   - **Example:**
   - The cuckoo (*koel*) lays its eggs in the nest of a crow.

Impact of Parasitism on Hosts

- Reduces host survival, growth, and reproduction.
- Lowers population density of the host species.
- Makes the host more vulnerable to predators due to physical weakness.

Why Doesn't Natural Selection Favor Harmless Parasites?

- An ideal parasite would thrive without harming the host, but natural selection doesn't necessarily lead to completely harmless parasites.
- Some damage is inevitable due to the parasite's dependence on the host for survival.

Clue Finder

The female mosquito is not considered a parasite, although it needs our blood for reproduction. Female mosquitoes bite humans and animals to get blood to nourish their developing eggs. They need the protein found in blood to develop their eggs. Unlike parasites, which rely on their hosts for all their nutritional needs, female mosquitoes don't depend solely on their hosts for sustenance. Female mosquitoes don't harm humans for survival, they don't live off the host continuously.

(iv) Commensalism:

Definition:

- A type of interaction in which one species **benefits**, while the other is **neither harmed nor benefited**.
- The benefiting species gains advantages such as food, shelter, or protection, while the host species remains unaffected.

Examples:

1. **Orchid on a Mango Tree:**
   - The **orchid** benefits by getting structural support from the mango tree.
   - The **mango tree** is unaffected.
2. **Barnacles on Whales:**
   - Barnacles get a place to attach and access more food due to the whale's movement.
   - The **whale** experiences no significant benefit or harm.
3. **Cattle Egret and Grazing Cattle:**
   - Egrets benefit because cattle movement disturbs insects, making them easier to catch.
   - The **cattle** remain unaffected.
4. **Clownfish and Sea Anemone:**
   - Clownfish gains protection from predators by living among anemone's stinging tentacles.
   - The **anemone** does not gain any clear advantage from the fish's presence.

(v) Mutualism:

Definition:

- A type of interaction where both species benefit from their association.

- Mutualistic relationships are essential for **ecosystem stability and species survival**.

A. Fungi-Plant Mutualism

1. Lichens:

- A mutualistic association between **fungus** and **algae/cyanobacteria**.
- **Algae** provide food through **photosynthesis**, while the **fungus** offers protection and absorbs nutrients.

2. Mycorrhizae:

- **Association between fungi and plant roots.**
- **Fungi help plants absorb essential nutrients like phosphorus from the soil.**
- **Plants** provide fungi with **energy-rich carbohydrates**.

B. Plant-Animal Mutualism

1. Pollination Mutualism:

- **Plants rely on animals for pollination and seed dispersal.**
- **Animals receive pollen, nectar, or fruit as rewards.**
- **Example**: **Bees pollinating flowers in exchange for nectar.**

2. Seed Dispersal Mutualism:

- **Birds and mammals eat juicy fruits and disperse seeds.**
- **This** helps in plant **reproduction and expansion**.

3. Fig Tree and Wasp Mutualism:

- Many fig species have a **one-to-one mutualistic relationship** with specific **wasp species**.
- The **fig tree** depends on wasps for pollination.
- The **wasp** lays eggs in the fig fruit and its larvae **feed on developing seeds**.
- This **co-evolution** ensures both species survive.

Fig.: Mutual relationship between fig tree and wasp:
(a) Fig flower is pollinated by wasp; (b) Wasp laying eggs in a fig fruit

C. Specialized Mutualism (Co-evolution in Pollination)

1. Orchids and Pollinators:

- Orchids have evolved diverse **floral structures** to attract specific **pollinator insects (bees, bumblebees, etc.)**.
- Some orchids provide **nectar**, while others trick pollinators into pollination.

2. Sexual Deception in Ophrys Orchid:

- The Mediterranean orchid **Ophrys** uses **sexual deception** to attract male bees.
- One of its **petals resembles a female bee** in **size, color, and markings**.
- Male bees attempt to **mate with the flower (pseudocopulation)**, unknowingly transferring **pollen** to another flower.
- This ensures pollination without offering nectar.

Fig.: Showing bee-a pollinator on orchid flower

Co-Evolution in Mutualism

- Mutualistic relationships **evolve together**, meaning if one species changes, the other must also adapt.
- Example:
  - If the **female bee's appearance changes**, the **Ophrys orchid** must also evolve to maintain its resemblance. Otherwise, pollination success will decline, affecting both species.

TOPIC CENTRIC EXERCISE -02

Q1. What type of interaction transfer energy fixed by autotrophs in community?
(a) Predation (b) Parasitism
(c) Commensalism (d) Mutualism

Q2. Plant and their pollinator show -
(a) Commensalism (b) Mutualism
(c) Competition (d) Predation

Q3. Lichen is example of -
(a) Interaction between algae and fungi
(b) Interaction between algae and plant root
(c) Interaction between cyanobacteria and algae
(d) Interaction between fungi and plant root

Q4. Role of predation in ecosystem is -
(a) To transfer energy from animals to plants (b) To maintain prey population
(c) To maintain predator species (d) All of them

Q5. Orchid on mango tree is -
(a) Predator (b) Parasite
(c) Epiphyte (d) None of them

Comparison of parasitism, predation, competition, commensalism, and mutualism

Feature	Parasitism	Predation	Competition	Commensalism	Mutualism
Definition	One species (parasite) benefits at the expense of the host.	One species (predator) kills and consumes another (prey).	Two species compete for the same resources.	One species benefits, while the other is unaffected.	Both species benefit from the interaction.
Effect on Species	Host is harmed, parasite benefits.	Prey is harmed, predator benefits.	Both species are negatively affected.	One benefits, the other is unaffected.	Both species benefit.
Example	Tapeworm in human intestine.	Lion hunting a deer.	Two plants competing for sunlight.	Barnacles on a whale.	Bees and flowers (pollination).

Type of Interaction	Exploitative (one-sided harm).	Exploitative (immediate harm).	Competitive (both suffer).	Non-harmful (one-sided benefit).	Symbiotic (mutual benefit).
Dependency	Parasite depends on the host for survival.	Predator does not depend on one specific prey.	Species compete but do not depend on each other.	The benefiting species relies on the host for support.	Both species rely on each other for survival or benefits.

Solved Examples

Ex: 1- How many levels of biological organisation has in concern with ecology

(a) One (b) Five

(c) Four (d) Three

Sol. (c): Ecology considers four main levels—organism, population, community, and ecosystem.

Ex: 2- If the age distribution is plotted for the population, the resulting structure is called-

(a) Population attributes (b) Population ecology

(c) Age pyramids (d) None of these

Sol. (c): Age pyramids visually represent the age distribution in a population.

Ex: 3- The tiger census in our national parks and tiger reserves is based on-

(a) Pug marks (b) Fecal pellets

(c) Counting numbers of tigers (d) Both (a) and (b)

Sol. (d): Tiger population is estimated using indirect evidence like pug marks and fecal pellets.

Ex: 4- The density of a population at given habitat fluctuates due to -

(a) Birth, deaths, immigration, emigration (b) Births and deaths only

(c) Birth and immigration only (d) Death and emigration only

Sol. (a): All four factors influence population density changes in an ecosystem.

Ex: 5- Which statement is correct for logistic growth?

(a) It includes carrying capacity (K) as limit in population growth.

(b) It occurs in habitat having unlimited resources.

(c) It is a J shaped curved.

(d) Only (a) and (b)

Sol. (a): Logistic growth shows population growth slowing near carrying capacity.

Ex: 6- Prickly pear cactus caused havoc in the early 1920's in-

(a) Canada (b) Austria

(c) India (d) Australia

Sol. (d): This cactus became invasive in Australia, disrupting the native ecosystem.

Ex: 7- Which of the following is not a function of predators?

(a) They decrease the prey species competition in a community

(b) They act as conduits for energy transfer access trophic levels

(c) They help in stabilization of the ecosystem

(d) They decrease the species diversity in a community

Sol. (d): Predators usually help maintain species diversity by controlling prey populations.

Ex: 8- Who showed that 5 closely related species of Warblers living on same tree were able to avoid competition and co-exist by behavioural difference?

(a) C. Darwin (b) Connell

(c) Mac Arther (d) Gause

Sol. (c): R.H. MacArthur's classic study demonstrated niche partitioning in warblers.

Ex: 9- Mark the correct statement from given below-

(a) Orchid provides physical benefit to mango tree where it stays inside of plant.

(b) Egrets always forge from far to where cattle graze.

(c) Clown fish get protection from predators which stay away from the stinging tentacles.
(d) The anemone drive benefits from clown fish.

Sol. **(c):** Clown fish are immune to the stings of sea anemones, gaining protection.

Ex: 10- Pseudocopulation is an example of-

(a) Wasp species and fig (b) Ophrys and bee species
(c) Ophrys and wasp species (d) None of these

Sol. **(b):** Ophrys orchid mimics a female bee, tricking male bees into pollinating it via pseudocopulation.

Exercise-01 Level -01

1. What are the two types of questions we can ask about biological processes at any level of biological organization?
   (a) When and Where
   (b) How and Why
   (c) What and Who
   (d) Which and How
2. Which of the following is NOT an example of a population in ecological studies?
   (a) All the cormorants in a wetland
   (b) Rats in an abandoned dwelling
   (c) Teakwood trees in a forest tract
   (d) A single elephant in a forest
3. What term is used to describe the number of births per capita in a population?
   (a) Mortality (b) Natality
   (c) Immigration (d) Emigration
4. What is the primary purpose of studying population ecology?
   (a) To understand the survival strategies of individual organisms
   (b) To link ecology to population genetics and evolution
   (c) To study the genetic makeup of a species
   (d) To examine the geographical distribution of species
5. In population ecology, what does "sex ratio" refer to?
   (a) The proportion of males to females in a population
   (b) The total number of males and females in a habitat
   (c) The age distribution of males and females
   (d) The ratio of individuals in different populations
6. What is an "age pyramid" used to represent in a population?
   (a) The birth rate of a species
   (b) The population density of the species
   (c) The age distribution of individuals in a population
   (d) The sex ratio in a population
7. Which of the following statements is true about population size?
   (a) It is always measured by the total number of individuals
   (b) It is determined by the birth rate alone
   (c) It can be expressed as population density or biomass
   (d) It only refers to the number of species in a habitat
8. Which of the following is a measure of population size when counting individuals is not feasible?
   (a) Population density (b) Relative density
   (c) Sex ratio (d) Age distribution
9. What is the equation used to calculate changes in population density?
   (a) N = B - D
   (b) $N_{t+1} = N_t + [(B + I) - (D + E)]$
   (c) r = (b - d) × N
   (d) N = K + r
10. Which of the following contributes to an increase in population density?
   (a) Mortality and emigration
   (b) Mortality and immigration
   (c) Natality and immigration
   (d) Emigration and natality
11. What factor is primarily responsible for the fluctuation of population density?
   (a) Immigration (b) Natality
   (c) Mortality (d) All of the above
12. What growth model describes a population growing under unlimited resource conditions?
   (a) Exponential growth (b) Logistic growth
   (c) Linear growth (d) Cyclical growth
13. In an exponential growth model, what does the variable "r" represent?
   (a) The carrying capacity of the habitat
   (b) The intrinsic rate of natural increase
   (c) The number of births in a given period
   (d) The number of deaths in a given period
14. What is true for size of population?
   (a) It is a non-static parameter for any species
   (b) A population does not change with time
   (c) It is not dependent on various ecological factor
   (d) All of them
15. What is the main difference between exponential and logistic growth?
   (a) Logistic growth occurs under unlimited resources, while exponential growth occurs under limited resources

(b) Exponential growth is rapid and does not level off, while logistic growth levels off at carrying capacity
(c) Logistic growth occurs only in plant populations, while exponential growth occurs only in animal populations
(d) Exponential growth is slower than logistic growth

16. What is the "carrying capacity" (K) of a habitat?
(a) The maximum population size a habitat can support
(b) The minimum amount of resources needed for survival
(c) The point at which a population begins to grow exponentially
(d) The rate of population increases when resources are unlimited

17. Which of the following best describes the population growth curve for logistic growth?
(a) J-shaped curve (b) Sigmoid curve
(c) Linear curve (d) Parabolic curve

18. Which type of population growth would occur if a species has access to unlimited resources?
(a) Logistic growth (b) Exponential growth
(c) Cyclic growth (d) Declining growth

19. In a population growing exponentially, what happens when the intrinsic rate of natural increase (r) is high?
(a) The population grows slowly
(b) The population grows rapidly
(c) The population stays stable
(d) The population starts to decline

20. Which of the following is an example of a "lag phase" in logistic growth?
(a) The population rapidly exceeds the carrying capacity
(b) The population slowly adjusts to the new environment
(c) The population reaches its carrying capacity immediately
(d) The population experiences a sharp decline

21. What is Darwinian fitness?
(a) Survival of the fittest
(b) Ability to produce large offspring
(c) Ability to maximize reproductive success
(d) Ability to survive without competition

22. Which organisms breed only once in their lifetime?
(a) Most mammals (b) Pacific salmon fish
(c) Oysters (d) Most birds

23. Which organisms produce large-sized offspring?
(a) Oysters (b) Pelagic fishes
(c) Birds (d) Bamboo

24. How do ecologists suggest life history traits evolve?
(a) In response to climate change
(b) Based on genetic drift
(c) In relation to habitat constraints
(d) By random mutations

25. What type of interactions arise from the interaction of populations of two different species?
(a) Intraspecific interactions
(b) Interpreted interactions
(c) Interspecific interactions
(d) Symbiotic interactions

26. What is the outcome of mutualism?
(a) One species benefits while the other is harmed
(b) Both species benefit
(c) Both species are unaffected
(d) Both species lose

27. What is an example of commensalism?
(a) Pollination of flowers by bees
(b) The relationship between cattle egrets and grazing cattle
(c) The relationship between predator and prey
(d) The parasitic relationship between lice and humans

28. What type of interaction involves one species benefiting and the other being harmed?
(a) Amensalism (b) Mutualism
(c) Parasitism (d) Commensalism

29. What happens to prey populations without predators?
(a) They can grow uncontrollably
(b) They decrease in number
(c) They stabilize at an optimal size
(d) They evolve into new species

30. What role do predators play in ecosystems?
(a) They control prey populations
(b) They eliminate all competition
(c) They help prey species thrive
(d) They do not affect prey species

31. What is biological control based on?
(a) Using chemical pesticides
(b) Introducing predators to control prey populations
(c) Reducing species diversity
(d) Encouraging species extinction

32. Which of the following is a defence mechanism against predation in prey species?
(a) Migration
(b) High reproductive rate
(c) Camouflage
(d) Becoming juicy in nature

33. What is the main defence mechanism used by plants against herbivores?
(a) Thorns (b) Rapid growth
(c) Speed of dispersal (d) Tolerance to grazing

34. How do plants like Calotropis defend themselves against herbivores?
(a) By attracting herbivores
(b) By producing toxic chemicals
(c) By growing faster than herbivores can feed
(d) By producing fruits that are difficult to access

35. Interspecific competition occurs when species:
(a) Compete for space only
(b) Compete for the same resources
(c) Do not interact at all
(d) Live in different geographical areas

36. Competitive exclusion principle is true for
(a) Closely related species competing for same resources with unlimited resource
(b) Fae related species competing for same resources with unlimited resource
(c) Closely related species competing for the different resources
(d) Closely related species competing for same resources with limited resource

37. What is 'competitive release'?
(a) The introduction of a new species into an area
(b) The removal of a species leading to the expansion of another species
(c) The forced migration of a species
(d) The extinction of a species due to competition

38. Which of the following demonstrates resource partitioning?
(a) Two species of birds eating the same food at the same time
(b) Two species of warblers foraging at different times
(c) Two species of lions competing for prey
(d) One species of fish eating all available plankton

39. What does Gause's Competitive Exclusion Principle state?
(a) All species can coexist indefinitely
(b) Two closely related species cannot coexist if they compete for the same resources
(c) Competition does not affect species survival
(d) Interspecific competition is always beneficial for both species

40. What is a characteristic feature of endoparasites?
(a) They live on the host's surface
(b) They feed on external organs
(c) They have highly simplified morphological features
(d) They have complex life cycles involving several hosts

41. Why do parasites evolve special adaptations?
(a) To increase their size
(b) To reduce their energy consumption
(c) To neutralize host defenses
(d) To improve their reproduction rate

42. Which parasite requires an intermediate host to complete its life cycle?
(a) Malaria parasite (b) Cuscuta
(c) Lice (d) Copepods

43. What is the primary difference between ectoparasites and endoparasites?
(a) Ectoparasites live inside the host body, while endoparasites live on the surface
(b) Ectoparasites are microscopic, while endoparasites are larger
(c) Ectoparasites live on the surface of the host, while endoparasites live inside
(d) There is no difference between them

44. How do parasitic plants like Cuscuta obtain nutrients?
(a) By photosynthesis
(b) By absorbing nutrients from the soil
(c) By parasitizing other plants for nutrients
(d) By absorbing nutrients from animals

45. What is brood parasitism in birds?
(a) Birds laying eggs in their own nests
(b) Birds feeding on their eggs
(c) Birds laying eggs in the nests of other species
(d) Birds migrating to avoid predators

46. What feature helps parasitic birds reduce the chances of their eggs being detected?
(a) Large size of eggs
(b) Similarity of their eggs to the host's eggs
(c) Bright coloration of eggs
(d) High number of eggs

47. What is the interaction between sea anemones and clown fish an example of?
(a) Commensalism (b) Mutualism
(c) Parasitism (d) Competition

48. What does mutualism involve?
(a) One species benefits while the other is harmed
(b) Both species benefit from the interaction
(c) Neither species benefits
(d) One species is unaffected

49. Which of the following is an example of mutualism in plants?
(a) Fig tree and wasp
(b) Cactus and herbivores
(c) Predator and prey
(d) Cuscuta and host plant

50. What do plants offer animals in exchange for pollination?
(a) Fruits (b) Nectar and pollen
(c) Leaves (d) Shelter

Exercise-02 Level -02

1. Read the following statement:
I. Our living world is diverse and complex.
II. Biological organisation can be studied at different levels like cells, tissues, organs, and organisms.
III. Understanding complexity is essential for solving ecological problems.
Choose the correct option from below-
(a) Only I is correct.
(b) Only II is correct.
(c) Only III is correct.
(d) I, II, and III are correct.

2. Read the following statement:
I. Ecology studies the interactions among organisms and between organisms and their environment.
II. The primary levels of biological organisation in ecology are organisms, populations, communities, and biomes.
III. Ecology exclusively deals with individual organisms, ignoring populations.
Choose the correct option from below-
(a) Only I is correct.
(b) Only II is correct.
(c) Only III is correct.
(d) I and II are correct.

3. Read the following statement:
I. A population consists of a group of individuals of the same species living in a defined area.
II. Populations do not interact with one another or share resources.
III. Population ecology links ecology to genetics and evolution.
Choose the correct option from below-
(a) Only I is correct.
(b) Only II is correct.
(c) Only III is correct.
(d) I and III are correct.

4. Read the following statement:
I. Population size is an important factor in understanding the status of a species in its habitat.
II. Population density refers to the total number of individuals in a given area.
III. Population density is always measured by counting individuals.
Choose the correct option from below-
(a) Only I is correct.
(b) Only II is correct.
(c) Only III is correct.
(d) I and II are correct.

5. Read the following statement:
I. Population size is an unchanging number that reflects species stability.
II. Population growth is determined by natality, mortality, immigration, and emigration.
III. Mortality refers to the number of individuals who leave the population.
Choose the correct option from below-
(a) Only I is correct.
(b) Only II is correct.
(c) Only III is correct.
(d) I and II are correct.

6. Read the following statement:
I. The size of a population is influenced by natality, mortality, immigration, and emigration.
II. Immigration always decreases the size of a population.

III. Emigration is when individuals leave the habitat and can decrease population density.

Choose the correct option from below-

(a) Only I is correct.
(b) Only II is correct.
(c) Only III is correct.
(d) I and III are correct.

7. Read the following statement:

I. Exponential growth occurs when resources are limited.
II. Exponential growth leads to a J-shaped population curve.
III. Exponential growth is characterized by an unlimited increase in population size.

Choose the correct option from below-

(a) Only I is correct.
(b) Only II is correct.
(c) Only III is correct.
(d) II and III are correct.

8. Read the following statement:

I. The intrinsic rate of natural increase, r, is a parameter used to assess the impact of biotic or abiotic factors on population growth.
II. Exponential growth occurs when population density reaches the carrying capacity.
III. The intrinsic rate of natural increase (r) is calculated by the formula (b – d).

Choose the correct option from below-

(a) Only I is correct.
(b) Only II is correct.
(c) Only III is correct.
(d) I and III are correct.

9. Read the following statement:

I. Logistic growth is more realistic than exponential growth due to limited resources in nature.
II. Logistic growth leads to a J-shaped curve.
III. Carrying capacity (K) is the maximum population size that an environment can support.

Choose the correct option from below-

(a) Only I and II is correct.
(b) Only II and III is correct.
(c) Only I and III is correct.
(d) I, II and III are correct.

10. Read the following statement:

I. The growth of a population eventually reaches a limit known as the carrying capacity.
II. Logistic growth results in a sigmoid curve when plotted against time.
III. The logistic growth model is based on the assumption of unlimited resources.

Choose the correct option from below-

(a) Only I and II is correct.
(b) Only II and III is correct.
(c) Only I and III is correct.
(d) I, II and III are correct.

11. Read the following statement:

I. The age pyramid shows the age distribution of a population.
II. The age pyramid reflects whether a population is growing, stable, or declining.
III. The age pyramid is only applicable to human populations.

Choose the correct option from below-

(a) Only I is correct.
(b) Only II is correct.
(c) Only III is correct.
(d) I and II are correct.

12. Read the following statement:

I. Population growth can be studied by calculating per capita birth and death rates.
II. The birth rate is defined as the total number of births in a population.
III. The death rate refers to the number of deaths per individual organism.

Choose the correct option from below-

(a) Only I and II is correct.
(b) Only II and III is correct.
(c) Only I and III is correct.
(d) I, II and III are correct.

13. Read the following statement:

I. Exponential growth models assume unlimited resources and infinite space.
II. Logistic growth includes competition for limited resources.
III. The carrying capacity is the point at which a population can no longer grow.

Choose the correct option from below-

(a) Only I is correct.
(b) Only II is correct.
(c) Only III is correct.
(d) I, II, and III are correct.

14. Read the following statement:

I. Emigration increases population size.
II. Immigration decreases population size.
III. Immigration is the arrival of individuals into a population from another area.

Choose the correct option from below-

(a) Only I is correct.
(b) Only II is correct.
(c) Only III is correct.
(d) II and III are correct.

15. Read the following statement:
I. A population is defined by the interaction and reproduction of individuals within a species.
II. The population's age structure and sex ratio are not important for ecological studies.
III. Population attributes include birth rates, death rates, and sex ratios.
Choose the correct option from below-
(a) Only I is correct.
(b) Only II is correct.
(c) Only III is correct.
(d) I and III are correct.

16. Read the following statement:
I. A species can grow exponentially only if there are no environmental constraints.
II. Logistic growth is often seen in populations with limited resources.
III. A population growing exponentially will eventually reach its carrying capacity.
Choose the correct option from below-
(a) Only I and II is correct.
(b) Only II and III is correct.
(c) Only I and III is correct.
(d) I, II and III are correct.

17. Read the following statement:
I. The age pyramid for a population can indicate its growth trend.
II. Populations at carrying capacity show no further increase in size.
III. Growth curves are useful in predicting population dynamics.
Choose the correct option from below-
(a) Only I is correct.
(b) Only II is correct.
(c) Only III is correct.
(d) I, II, and III are correct.

18. Read the following statement:
I. In nature, populations grow exponentially when resources are limited.
II. A population at carrying capacity exhibits exponential growth.
III. Carrying capacity is determined by the total number of individuals that can be supported.
Choose the correct option from below-
(a) Only I and II is correct.
(b) Only II and III is correct.
(c) Only I and III is correct.
(d) I, II and III are correct.

19. Read the following statement:
I. Population size is a static factor that does not change over time.
II. Both birth and death rates influence population growth.
III. Emigration refers to the movement of individuals out of a population.
Choose the correct option from below-
(a) Only I and II is correct.
(b) Only II and III is correct.
(c) Only I and III is correct.
(d) I, II and III are correct.

20. Read the following statement:
I. Exponential growth follows a J-shaped curve.
II. Logistic growth follows a sigmoid curve.
III. Logistic growth occurs in populations with unlimited resources.
Choose the correct option from below-
(a) Only I and II is correct.
(b) Only II and III is correct.
(c) Only I and III is correct.
(d) I, II and III are correct.

21. Read the following statement:
I. Populations evolve to maximize their reproductive fitness in their habitat.
II. Some organisms breed once in their lifetime, while others breed multiple times.
III. Life history traits have evolved in relation to the habitat's abiotic and biotic components.
Choose the correct option from below-
(a) Only I is correct.
(b) Only I and II are correct.
(c) Only II and III are correct.
(d) All statements are correct.

22. Read the following statement:
I. The evolution of life history traits in organisms is an important area of research in ecology.
II. Organisms breed once in their lifetime to maximize fitness.
III. Life history traits are solely influenced by abiotic factors.
Choose the correct option from below-
(a) Only I and II is correct.
(b) Only II and III is correct.
(c) Only I and III is correct.
(d) I, II and III are correct.

23. Read the following statement:
I. Some organisms produce a large number of small offspring.

II. Some organisms produce a small number of large offspring.
III. Fitness is determined only by the number of offspring produced.

Choose the correct option from below-
(a) Only I and II are correct.
(b) Only I and III are correct.
(c) Only II and III are correct.
(d) All statements are correct.

24. Read the following statement:
I. Life history traits are the result of interactions between organisms and their habitat.
II. Organisms can breed in various habitats based on abiotic factors alone.
III. Evolution of life history traits ensures organisms maximize their Darwinian fitness.

Choose the correct option from below-
(a) Only I is correct.
(b) Only II is correct.
(c) Only III is correct.
(d) I and III are correct.

25. Read the following statement:
I. In nature, all species interact in a community.
II. A plant species can survive without any interaction with other species.
III. Species interactions can only be beneficial or detrimental.

Choose the correct option from below-
(a) Only I is correct.
(b) Only II is correct.
(c) Only III is correct.
(d) I and III are correct.

26. Read the following statement:
I. Commensalism is a type of interspecific interaction.
II. In mutualism, both species benefit from the interaction.
III. In parasitism, both species are harmed.

Choose the correct option from below-
(a) Only I and II is correct.
(b) Only II and III is correct.
(c) Only I and III is correct.
(d) I, II and III are correct.

27. Read the following statement:
I. Predation plays a key role in energy transfer across trophic levels.
II. Predator-prey interactions only affect the predator population.
III. Predators can regulate prey populations and prevent ecosystem instability.

Choose the correct option from below-
(a) Only I and III are correct.
(b) Only II is correct.
(c) Only I and II are correct.
(d) All statements are correct.

28. Read the following statement:
I. Herbivores are considered predators in a broad ecological context.
II. Herbivores typically feed on plants, which are the producers in an ecosystem.
III. Insects that feed on plant sap are called carnivores.

Choose the correct option from below-
(a) Only I and II are correct.
(b) Only II and III are correct.
(c) Only I and III are correct.
(d) All statements are correct.

29. Read the following statement:
I. Plants cannot escape herbivores like animals can escape predators.
II. Thorns are a common defense mechanism against herbivores in plants.
III. Plants use chemical substances to defend against herbivores.

Choose the correct option from below-
(a) Only I and II are correct.
(b) Only II and III are correct.
(c) Only I and III are correct.
(d) All statements are correct.

30. Read the following statement:
I. Competition occurs only when two species are closely related.
II. Interspecific competition can occur even if resources are not limiting.
III. Interference competition can happen even when resources are abundant.

Choose the correct option from below-
(a) Only I and II is correct.
(b) Only II and III is correct.
(c) Only I and III is correct.
(d) I, II and III are correct.

31. Read the following statement:
I. Competition occurs when two species compete for the same resources.
II. Species can coexist if they are good at sharing resources.
III. Species with similar ecological niches will never compete.

Choose the correct option from below-
(a) Only I and II is correct.
(b) Only II and III is correct.

(c) Only I and III is correct.
(d) I, II and III are correct.

32. Read the following statement:
I. The Competitive Exclusion Principle states that two species competing for the same resources cannot coexist indefinitely.
II. Gause's experiments support the idea that competitive exclusion leads to the elimination of the inferior species.
III. species shows coexistence by resource partitioning.
Choose the correct option from below-
(a) Only I and II is correct.
(b) Only II and III is correct.
(c) Only I and III is correct.
(d) I, II and III are correct.

33. Read the following statement:
I. Gause's 'Competitive Exclusion Principle' has been universally observed in nature.
II. Evidence for competitive exclusion in nature is not always conclusive.
III. Competitive release occurs when a competitor species is removed, allowing others to expand their range.
Choose the correct option from below-
(a) Only I and II is correct.
(b) Only II and III is correct.
(c) Only I and III is correct.
(d) I, II and III are correct.

34. Read the following statement:
I. Resource partitioning occurs when species share resources.
II. Species may use different methods or times to avoid competition.
III. Resource partitioning is only seen in closely related species.
Choose the correct option from below-
(a) Only I and II is correct.
(b) Only II and III is correct.
(c) Only I and III is correct.
(d) I, II and III are correct.

35. Read the following statement:
I. Parasitism occurs in a variety of taxonomic groups, including plants and higher vertebrates.
II. Parasites generally evolve to be host-specific.
III. Parasites tend to co-evolve with their hosts.
Choose the correct option from below-
(a) Only I is correct.
(b) Only II is correct.
(c) Only III is correct.
(d) All statements are correct.

36. Read the following statement:
I. Parasites rely on their hosts for nutrition and shelter.
II. Parasites have evolved adaptations such as adhesive organs to cling to hosts.
III. Parasites never harm their hosts.
Choose the correct option from below-
(a) Only I and II is correct.
(b) Only II and III is correct.
(c) Only I and III is correct.
(d) I, II and III are correct.

37. Read the following statement:
I. Endoparasites live inside the host, often in the liver, kidneys, or blood cells.
II. Ectoparasites live on the host's external surface.
III. A mosquito is considered an endoparasite.
Choose the correct option from below-
(a) Only I and II is correct.
(b) Only II and III is correct.
(c) Only I and III is correct.
(d) I, II and III are correct.

38. Read the following statement:
I. Brood parasitism is when a bird lays its eggs in the nest of another species.
II. The parasitic bird's eggs resemble the host's eggs in size and color.
III. The host bird raises the parasitic eggs as its own.
Choose the correct option from below-
(a) Only I is correct.
(b) Only II is correct.
(c) Only III is correct.
(d) I, II, and III are correct.

39. Read the following statement:
I. Commensalism is a type of interaction where one species benefits and the other is unaffected.
II. Barnacles growing on a whale are an example of commensalism.
III. Both species in a commensal relationship benefit equally.
Choose the correct option from below-
(a) Only I and II is correct.
(b) Only II and III is correct.
(c) Only I and III is correct.
(d) I, II and III are correct.

40. Read the following statement:

I. Mutualism benefits both interacting species.
II. Lichens are an example of mutualism between fungi and algae.
III. Mutualistic relationships do not involve energy exchange between species.

Choose the correct option from below-
(a) Only I is correct.
(b) Only II is correct.
(c) Only III is correct.
(d) I and II are correct.

41. Read the following statement:
I. The co-evolution of plant-pollinator relationships leads to interdependent evolutionary changes.
II. Orchids often attract specific pollinators through floral patterns.
III. Co-evolution in plant-pollinator relationships is not common in nature.

Choose the correct option from below-
(a) Only I and II is correct.
(b) Only II and III is correct.
(c) Only I and III is correct.
(d) I, II and III are correct.

42. Read the following statement:
I. Pollinators are attracted to flowers through visual and olfactory signals.
II. The fig tree-pollinator wasp relationship is an example of mutualism.
III. The fig tree-pollinator wasp relationship is only a one-way interaction.

Choose the correct option from below-
(a) Only I is correct.
(b) Only II is correct.
(c) Only III is correct.
(d) I and II are correct.

43. Read the following statement:
I. Orchids employ sexual deceit for pollination.
II. Male bees are attracted to the orchid flowers for mating.
III. Orchids reward pollinators with nectar to ensure pollination.

Choose the correct option from below-
(a) Only I and II is correct.
(b) Only II and III is correct.
(c) Only I and III is correct.
(d) I, II and III are correct.

44. Read the following statement:
I. Parasites can evolve complex life cycles involving intermediate hosts.
II. Parasites typically need a vector for transmission.
III. Parasites evolve to be host-specific.

Choose the correct option from below-
(a) Only I is correct.
(b) Only II is correct.
(c) Only III is correct.
(d) I, II, and III are correct.

45. Read the following statement:
I. Parasitism benefits only the parasite.
II. The host is always harmed by parasitism.
III. Parasitic adaptations may include loss of sense organs.

Choose the correct option from below-
(a) Only I is correct.
(b) Only II is correct.
(c) Only III is correct.
(d) I and III are correct.

46. Read the following statement:
I. Commensalism does not benefit the host species.
II. Orchids growing on mango trees are an example of commensalism.
III. Commensal species may affect their host directly.

Choose the correct option from below-
(a) Only I and II is correct.
(b) Only II and III is correct.
(c) Only I and III is correct.
(d) I, II and III are correct.

47. Read the following statement:
I. The mutualistic relationship involves coevolution of flowers and its pollinator.
II. Plants pay pollinators by providing nectar and pollen.
III. Mutualism benefits both plant and pollinator.

Choose the correct option from below-
(a) Only I and II is correct.
(b) Only II and III is correct.
(c) Only I and III is correct.
(d) I, II and III are correct.

48. Read the following statement:
I. Parasitism is the only interspecific interaction that harms both species.
II. Brood parasitism involves laying eggs in the host's nest.
III. The eggs of parasitic bird have evolved to resemble the host egg.

Choose the correct option from below-
(a) Only I is correct.

(b) Only II is correct.
(c) Only III is correct.
(d) II and III are correct.

49. Read the following statement:
I. Commensalism benefits one species and does not harm the other.
II. The cattle egret and grazing cattle show commensalism.
III. Commensalism always involves close physical contact.
Choose the correct option from below-
(a) Only I and II is correct.
(b) Only II and III is correct.
(c) Only I and III is correct.
(d) I, II and III are correct.

50. Read the following statement:
I. The fig tree and wasp relationship is an example of mutualism.
II. The fig offers food to the wasp in exchange for pollination.
III. The wasp does not contribute to the fig's reproductive success.
Choose the correct option from below-
(a) Only I is correct.
(b) Only II is correct.
(c) Only III is correct.
(d) I and II are correct

Exercise-03 Level -03

Assertion & Reason Based Questions

1. **Assertion (A):** The "how-type" questions in ecology focus on understanding the mechanism behind a process.
Reason (R): "How-type" questions seek to understand the significance of the process in an ecological system.
(a) Both A and R are correct, and R is the correct explanation of A.
(b) Both A and R are correct, but R is not the correct explanation of A.
(c) A is correct, but R is incorrect.
(d) A and R are incorrect.

2. **Assertion (A):** A population can consist of individuals resulting from both sexual and asexual reproduction.
Reason (R): Populations are defined by interbreeding individuals, regardless of their mode of reproduction.
(a) Both A and R are correct, and R is the correct explanation of A.
(b) Both A and R are correct, but R is not the correct explanation of A.
(c) A is correct, but R is incorrect.
(d) A and R are incorrect.

3. **Assertion (A):** Natural selection operates at the population level, not at the individual level.
Reason (R): Evolution occurs as populations adapt to changing environmental conditions.
(a) Both A and R are correct, and R is the correct explanation of A.
(b) Both A and R are correct, but R is not the correct explanation of A.
(c) A is correct, but R is incorrect.
(d) A and R are incorrect.

4. **Assertion (A):** A population's sex ratio is an attribute that applies to population.
Reason (R): The sex ratio refers to the proportion of males and females in a population, not an individual.
(a) Both A and R are correct, and R is the correct explanation of A.
(b) Both A and R are correct, but R is not the correct explanation of A.
(c) A is correct, but R is incorrect.
(d) A and R are incorrect.

5. **Assertion (A):** The age pyramid of a population reflects whether the population is growing, stable, or declining.
Reason (R): Age distribution is plotted for a population, showing the proportion of individuals in different age groups.
(a) Both A and R are correct, and R is the correct explanation of A.
(b) Both A and R are correct, but R is not the correct explanation of A.
(c) A is correct, but R is incorrect.
(d) A and R are incorrect.

6. **Assertion (A):** Population density can be measured in terms of the total number of individuals present in a given area.
Reason (R): Sometimes it is more meaningful to measure population size by percent cover or biomass rather than total numbers.

(a) Both A and R are correct, and R is the correct explanation of A.
(b) Both A and R are correct, but R is not the correct explanation of A.
(c) A is correct, but R is incorrect.
(d) A and R are incorrect.

7. **Assertion (A):** The population density of a species cannot be measured by simply counting the number of individuals in some cases.
Reason (R): Certain populations are too large or difficult to count directly, such as laboratory cultures of bacteria or wild tiger populations.
(a) Both A and R are correct, and R is the correct explanation of A.
(b) Both A and R are correct, but R is not the correct explanation of A.
(c) A is correct, but R is incorrect.
(d) A and R are incorrect.

8. **Assertion (A):** Population size fluctuates over time due to factors such as food availability and predation pressure.
Reason (R): The density of a population is influenced by four processes: natality, mortality, immigration, and emigration.
(a) Both A and R are correct, and R is the correct explanation of A.
(b) Both A and R are correct, but R is not the correct explanation of A.
(c) A is correct, but R is incorrect.
(d) A and R are incorrect.

9. **Assertion (A):** Immigration contributes to an increase in population density.
Reason (R): Immigration refers to individuals of the same species moving into a new habitat.
(a) Both A and R are correct, and R is the correct explanation of A.
(b) Both A and R are correct, but R is not the correct explanation of A.
(c) A is correct, but R is incorrect.
(d) A and R are incorrect.

10. **Assertion (A):** Exponential growth of a population occurs when resources are unlimited.
Reason (R): Exponential growth leads to rapid population expansion as the species fully realizes its innate potential to grow.
(a) Both A and R are correct, and R is the correct explanation of A.
(b) Both A and R are correct, but R is not the correct explanation of A.
(c) A is correct, but R is incorrect.
(d) A and R are incorrect.

11. **Assertion (A):** The intrinsic rate of natural increase (r) represents the rate at which a population grows under ideal conditions.
Reason (R): A high r- value indicates a high potential for population growth.
(a) Both A and R are correct, and R is the correct explanation of A.
(b) Both A and R are correct, but R is not the correct explanation of A.
(c) A is correct, but R is incorrect.
(d) A and R are incorrect.

12. **Assertion (A):** The logistic growth model is more realistic than exponential growth for populations in nature.
Reason (R): Logistic growth considers the limits of resources and carrying capacity, leading to competition among individuals.
(a) Both A and R are correct, and R is the correct explanation of A.
(b) Both A and R are correct, but R is not the correct explanation of A.
(c) A is correct, but R is incorrect.
(d) A and R are incorrect.

13. **Assertion (A):** Exponential growth results in a J-shaped population curve.
Reason (R): Exponential growth occurs when a population experiences unrestricted growth with unlimited resources.
(a) Both A and R are correct, and R is the correct explanation of A.
(b) Both A and R are correct, but R is not the correct explanation of A.
(c) A is correct, but R is incorrect.
(d) A and R are incorrect.

14. **Assertion (A):** A population's carrying capacity (K) represents the maximum number of individuals it can support.
Reason (R): The carrying capacity is determined by the resources available in the habitat.
(a) Both A and R are correct, and R is the correct explanation of A.
(b) Both A and R are correct, but R is not the correct explanation of A.
(c) A is correct, but R is incorrect.
(d) A and R are incorrect.

15. **Assertion (A):** The Verhulst-Pearl Logistic Growth model is represented by a sigmoid curve.
Reason (R): Logistic growth occurs when population density increases rapidly at first but slows as it approaches the carrying capacity.

(a) Both A and R are correct, and R is the correct explanation of A.
(b) Both A and R are correct, but R is not the correct explanation of A.
(c) A is correct, but R is incorrect.
(d) A and R are incorrect.

16. **Assertion (A):** Organisms that breed many times during their lifetime have evolved towards the most efficient reproductive strategy.
Reason (R): Organisms evolve reproductive strategies in relation to the selection pressures of their habitat.
(a) Both A and R are correct, and R is the correct explanation of A.
(b) Both A and R are correct, but R is not the correct explanation of A.
(c) A is correct, but R is incorrect.
(d) A and R are incorrect.

17. **Assertion (A):** Herbivores are considered predators in a broad ecological context.
Reason (R): Herbivores play a similar role to predators by transferring energy across trophic levels.
(a) Both A and R are correct, and R is the correct explanation of A.
(b) Both A and R are correct, but R is not the correct explanation of A.
(c) A is correct, but R is incorrect.
(d) A and R are incorrect.

18. **Assertion (A):** Mutualism is a relationship where both species benefit from the interaction.
Reason (R): In mutualistic interactions, both species depend on each other for survival and reproduction.
(a) Both A and R are correct, and R is the correct explanation of A.
(b) Both A and R are correct, but R is not the correct explanation of A.
(c) A is correct, but R is incorrect.
(d) A and R are incorrect.

19. **Assertion (A):** Interspecific competition always occurs when two species compete for the same resource.
Reason (R): Competition occurs only when species are closely related and share the same resources.
(a) Both A and R are correct, and R is the correct explanation of A.
(b) Both A and R are correct, but R is not the correct explanation of A.
(c) A is correct, but R is incorrect.
(d) A and R are incorrect.

20. **Assertion (A):** Competitive exclusion leads to the elimination of one of the competing species.
Reason (R): This principle applies only when resources are limiting.
(a) Both A and R are correct, and R is the correct explanation of A.
(b) Both A and R are correct, but R is not the correct explanation of A.
(c) A is correct, but R is incorrect.
(d) A and R are incorrect.

Statement Based Questions

21. **Statement I:** The complexity of living organisms can be understood by investigating various levels of biological organization.
Statement II: These levels of organization include macromolecules, cells, tissues, organs, individuals, populations, communities, ecosystems, and biomes.
(a) Statement I is correct but Statement II is incorrect.
(b) Statement II is correct but Statement I is correct.
(c) Both statements are correct.
(d) Both statements are incorrect.

22. **Statement I:** "How-type" questions ask about the mechanism behind a biological process.
Statement II: "Why-type" questions seek to understand the significance of a biological process.
(a) Statement I is correct but Statement II is incorrect.
(b) Statement II is correct but Statement I is correct.
(c) Both statements are correct.
(d) Both statements are incorrect.

23. **Statement I:** Population ecology links ecology to population genetics and evolution.
Statement II: An individual organism alone can evolve traits through natural selection.
(a) Statement I is correct but Statement II is incorrect.
(b) Statement II is correct but Statement I is correct.
(c) Both statements are correct.
(d) Both statements are incorrect.

24. **Statement I:** A population has attributes like birth rates and death rates, which are calculated per capita.
Statement II: A single individual organism has birth rates and death rates just like a population.

(a) Statement I is correct but Statement II is incorrect.
(b) Statement II is correct but Statement I is correct.
(c) Both statements are correct.
(d) Both statements are incorrect.

25. **Statement I:** A sex ratio refers to the number of males and females in a population.
Statement II: An individual organism is assigned a sex ratio of male or female at birth.
(a) Statement I is correct but Statement II is incorrect.
(b) Statement II is correct but Statement I is correct.
(c) Both statements are correct.
(d) Both statements are incorrect.

26. **Statement I:** The size of a population can indicate its status within a habitat.
Statement II: Population density always refers to the number of individuals in the population.
(a) Statement I is correct but Statement II is incorrect.
(b) Statement II is correct but Statement I is correct.
(c) Both statements are correct.
(d) Both statements are incorrect.

27. **Statement I:** Population density is always measured in terms of total numbers.
Statement II: In some cases, alternative measures like biomass or percent cover are used to describe population size.
(a) Statement I is correct but Statement II is incorrect.
(b) Statement II is correct but Statement I is correct.
(c) Both statements are correct.
(d) Both statements are incorrect.

28. **Statement I:** A population's density is often estimated indirectly using tools like pug marks or fecal pellets.
Statement II: Direct counting is always the most efficient way to measure population density.
(a) Statement I is correct but Statement II is incorrect.
(b) Statement II is correct but Statement I is correct.
(c) Both statements are correct.
(d) Both statements are incorrect.

29. **Statement I:** A population's growth is influenced by natality, mortality, immigration, and emigration.
Statement II: These factors always increase population size at a uniform rate.
(a) Statement I is correct but Statement II is incorrect.
(b) Statement II is correct but Statement I is correct.
(c) Both statements are correct.
(d) Both statements are incorrect.

30. **Statement I:** Exponential growth of a population occurs when resources are unlimited.
Statement II: Exponential growth results in a J-shaped curve when population size is plotted over time.
(a) Statement I is correct but Statement II is incorrect.
(b) Statement II is correct but Statement I is correct.
(c) Both statements are correct.
(d) Both statements are incorrect.

31. **Statement I:** Logistic growth occurs when there are unlimited resources in a habitat.
Statement II: Logistic growth occurs when resources are limited, leading to a stabilization at the carrying capacity.
(a) Statement I is correct but Statement II is incorrect.
(b) Statement II is correct but Statement I is correct.
(c) Both statements are correct.
(d) Both statements are incorrect.

32. **Statement I:** The intrinsic rate of natural increase (r) is constant in all species.
Statement II: The r value varies depending on the species and environmental conditions.
(a) Statement I is correct but Statement II is incorrect.
(b) Statement II is correct but Statement I is correct.
(c) Both statements are correct.
(d) Both statements are incorrect.

33. **Statement I:** A population growing exponentially can reach enormous numbers in a short period of time.
Statement II: Exponential growth is common for some animal populations in nature.
(a) Statement I is correct but Statement II is incorrect.
(b) Statement II is correct but Statement I is correct.
(c) Both statements are correct.
(d) Both statements are incorrect.

34. **Statement I:** The Verhulst-Pearl logistic growth model includes factors like carrying capacity and population density.
Statement II: Logistic growth always leads to a J-shaped curve in population size over time.
(a) Statement I is correct but Statement II is incorrect.
(b) Statement II is correct but Statement I is correct.
(c) Both statements are correct.
(d) Both statements are incorrect.

35. **Statement I:** The population growth curve for a species experiencing logistic growth is sigmoid in shape.
Statement II: The population will continue to grow exponentially without limitations.
(a) Statement I is correct but Statement II is incorrect.
(b) Statement II is correct but Statement I is correct.
(c) Both statements are correct.
(d) Both statements are incorrect.

36. **Statement I:** Some organisms breed only once during their lifetime.
Statement II: Organisms evolve reproductive strategies that maximize their fitness in the habitat they live.
(a) Statement I is correct but Statement II is incorrect.
(b) Statement II is correct but Statement I is correct.
(c) Both statements are correct.
(d) Both statements are incorrect.

37. **Statement I:** Predation plays an important role in regulating prey populations.
Statement II: Without predators, prey populations could increase and cause ecosystem instability.
(a) Statement I is correct but Statement II is incorrect.
(b) Statement II is correct but Statement I is correct.
(c) Both statements are correct.
(d) Both statements are incorrect.

38. **Statement I:** Herbivores are often considered predators in an ecological sense.
Statement II: Herbivores feed on plants, transferring energy to higher trophic levels.
(a) Statement I is correct but Statement II is incorrect.
(b) Statement II is correct but Statement I is correct.
(c) Both statements are correct.
(d) Both statements are incorrect.

39. **Statement I:** Mutualism benefits both interacting species.
Statement II: In mutualistic interactions, both species depend on each other for their survival.
(a) Statement I is correct but Statement II is incorrect.
(b) Statement II is correct but Statement I is correct.
(c) Both statements are correct.
(d) Both statements are incorrect.

40. **Statement I:** Competition occurs when two species use the same limited resource.
Statement II: Competition between species can occur even if resources are abundant.
(a) Statement I is correct but Statement II is incorrect.
(b) Statement II is correct but Statement I is correct.
(c) Both statements are correct.
(d) Both statements are incorrect.

Match up Based Questions

41. Match the terms with their correct descriptions.

Column-I		Column-II	
A.	Natality	I.	The number of deaths in a population during a time period
B.	Mortality	II.	The number of births in a population during a given time period.
C.	Emigration	III.	The number of individuals entering the population.
D.	Immigration	IV.	The number of individuals leaving the population.

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

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

42. Match the population growth types with their correct characteristics.

Column-I		Column-II	
A.	Exponential Growth	I.	Growth slows down as resources become limiting.
B.	Logistic Growth	II.	Growth occurs in a J-shaped curve due to unlimited resources.
C.	Carrying Capacity	III.	The maximum population size an environment can support.
D.	Intrinsic Rate of Natural Increase	IV.	The rate at which a population grows under ideal conditions.

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

43. Match the terms related to population attributes with their correct meanings.

Column-I		Column-II	
A.	Age Pyramid	I.	The total mass of living organisms in a specific area.
B.	Sex Ratio	II.	The number of individuals per unit area or volume in a habitat.
C.	Biomass	III.	The proportion of males and females in a population.
D.	Population Density	IV	The distribution of age groups in a population.

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

44. Match the terms related to population growth with their correct definitions.

Column-I		Column-II	
A.	Exponential Growth	I.	The birth rate in a population.
B.	Logistic Growth	II.	The death rate in a population.
C.	Natality	III.	Population grows with carrying capacity influenced by limited resources.
D.	Mortality	IV.	When the population grows rapidly due to unlimited resources.

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

45. Match the examples of populations with their correct characteristics.

Column-I		Column-II	
A.	Bamboo	I.	Small sized offsprings
B.	Oyster	II.	Large sized offsprings
C.	Birds	III.	Breed once in lifetime

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

46. Match the ecological interactions with their correct sign.

Column-I		Column-II	
A.	Mutualism	I.	+, -
B.	Predation	II.	-, -
C.	Commensalism	III.	+, +
D.	Competition	IV.	+, 0

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

47. Match the following term with their correct explanation.

Column-I		Column-II	
A.	Carrying capacity	I.	Parameter to assess impact on population growth
B.	Intrinsic rate of natural increase	II.	Population density reaches to carrying
C.	Asymptote	III.	Maximum number of individuals in a population

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

48. Match the following population attributes with their correct calculation methods.

Column-I		Column-II	
A.	Birth Rate	I.	The number of deaths in a population divided by total population.
B.	Death Rate	II.	The number of births in a population divided by total population.
C.	Population Density	III.	The number of individuals in a given area.

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

49. Match the following interspecific interactions with their correct descriptions:

Column-I		Column-II	
A.	Mutualism	I.	One species benefits and the other is neither harmed nor benefited.
B.	Commensalism	II.	Both species benefit from the interaction.
C.	Competition	III.	Both species harmed from the interaction.
D.	Predation	IV.	One species benefits and the other is harmed.

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

50. Match the concepts with their correct equations.

Column-I		Column-II	
A.	Exponential Growth Equation	I.	$\frac{dN}{dt} = (b - d) \times N$
B.	Logistic Growth Equation	II.	$\frac{dN}{dt} = rN\left(\frac{K-N}{K}\right)$
C.	Population Density	III.	N = total number of individuals in a given area.

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

Exercise-04 Previous Year Questions

1. The equation of Verhulst –Pearl logistic growth is $\frac{dN}{dt} = rN\left[\frac{K-N}{K}\right]$, From this equation, K indicates: **(2024)**
   (a) Biotic potential
   (b) Carrying capacity
   (c) Population density
   (d) Intrinsic rate of natural increase

2. Given below are two statements : **(2024)**
   Statement I: Gause's competitive exclusion principle states that two closely related species competing for different resources cannot exist indefinitely.
   Statement II: According to Gause's principle, during competition, the inferior will be eliminated. This may be true if resources are limiting.
   In the light of the above statements, choose the correct answer from the options given below:
   (a) Both Statement I and Statement II are false.
   (b) Statement I is true but Statement II is false.
   (c) Statement I is false but Statement II is true.
   (d) Both Statement I and Statement II are true.

3. Plants offer rewards to animals in the form of pollen and nectar and the animals facilitate the pollination process. This is an example of: **(2023)**
   (a) Amensalism (b) Competition
   (c) Commensalism (d) Mutualism

4. If there are 250 snails in a pond, and within a year their number increases to 2500 by reproduction. What should be their birth rate per snail per year? **(2023)**
   (a) 10 (b) 9
   (c) 25 (d) 15

5. **Statement I:** Gause's 'Competitive Exclusion Principle' states that two closely related species competing for the same resources cannot co-exist indefinitely and competitively inferior one will be eliminated eventually.
   Statement II: In general, carnivores are more adversely affected by competition than herbivores.
   In the light of the above statements, choose the correct answer from the options given below: **(2023)**
   (a) Both Statement I and Statement II are false.
   (b) Statement I is correct Statement II is false.
   (c) Statement I is incorrect but Statement II is true.
   (d) Both Statement I and Statement II are true.

6. Which one of the following statements cannot be connected to Predation? **(2022)**
   (a) It helps in maintaining species diversity in a community
   (b) It might lead to extinction of a species
   (c) Both the integrating species are negatively impacted
   (d) It is necessitated by nature to maintain the ecological balance

7. While explaining interspecific interaction of population, (+) sign is assigned for beneficial interaction, (-) sign is assigned for detrimental interaction and (0) for neutral interaction. Which of the following interactions can be assigned (+) for one specifies and (-) for another specifies involved in the interaction? **(2022)**
   (a) Predation (b) Amensalim
   (c) Commensalism (d) Competition

8. If '8' Drosophila in a laboratory population of '80' died during a week, the death rate in the population is week. individuals per Drosophila per **(2022)**
   (a) 0.1 (b) 10
   (c) 1.0 (d) zero

9. Inspite of interspecific competition in nature, which mechanism the competing species might have evolved for their survival? **(2021)**
   (a) Competitive release
   (b) Mutualism
   (c) Predation
   (d) Resource Partitioning

10. Amensalism can be represented as: **(2021)**
    (a) Species A (+) ; Species B (+)
    (b) Species A (–) ; Species B (–)
    (c) Species A (+) ; Species B (0)
    (d) Species A (–) ; Species B (0)

11. In the exponential growth equation $N_t = N_0 e^{rt}$, e represents: **(2021)**
    (a) The base of exponential logarithms
    (b) The base of natural logarithms
    (c) The base of geometric logarithms

(d) The base of number logarithms

12. Match List-I with List-II: **(2021)**

List-I		List-II	
A.	Allen's Rule	(i)	Kangaroo rat
B.	Physiological adaptation	(ii)	Desert lizard
C.	Behavioural adaptation	(iii)	Marine fish at depth
D.	Biochemical adaptation	(iv)	Polar seal

Choose the correct answer from the options given below.

(a) A-(iv), B-(i), C-(iii), D-(ii)
(b) A-(iv), B-(i), C-(ii), D-(iii)
(c) A-(iv), B-(iii), C-(ii), D-(i)
(d) A-(iv), B-(ii), C-(iii), D-(i)

13. **Assertion (A):** A person goes to high altitude and experiences 'altitude sickness' with symptoms like breathing difficulty and heart palpitations.
Reason (R): Due to low atmospheric pressure at high altitude, the body does not get sufficient oxygen.
In the light of the above statements, choose the correct answer from the options given below. **(2021)**

(a) Both (A) and (R) are true but (R) is not the correct explanation of (A)
(b) (A) is true but (R) is false
(c) (A) is false but (R) is true
(d) Both (A) and (R) are true and (R) is the correct explanation of (A)

14. Which of the following is not an attribute of a population? **(2020)**

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

15. Match the items in Column I with those in Column II: **(2020 Covid Re-NEET)**

Column-I		Column-II	
1.	Herbivores-Plants	(i)	Commensalism
2.	Mycorrhiza-Plants	(ii)	Mutualism
3.	Sheep-Cattle	(iii)	Predation
4.	Orchid-Tree	(iv)	Competition

(1) (2) (3) (4)

(a) (iii) (ii) (iv) (i)
(b) (ii) (i) (iii) (iv)
(c) (i) (iii) (iv) (ii)
(d) (iv) (ii) (i) (iii)

16. The impact of immigration on population density is: **(2020 Covid Re-NEET)**

(a) Both positive and negative
(b) Neutralized by natality
(c) Positive
(d) Negative

Answer keys

TOPIC CENTRIC EXERCISE-01 Answer Key

1. (d)	2. (c)	3. (b)	4. (b)	5. (b)

TOPIC CENTRIC EXERCISE-02 Answer Key

1. (a)	**2.** (b)	**3.** (a)	**4.** (b)	5. (c)

Exercise-01 Level -01 Answer Key

1. (b)	6. (c)	11. (d)	16. (a)	21. (c)	26. (b)	31. (b)	36. (d)	41. (c)	46. (b)
2. (d)	7. (c)	12. (a)	17. (b)	22. (b)	27. (b)	32. (c)	37. (b)	42. (a)	47. (a)
3. (b)	8. (b)	13. (b)	18. (b)	23. (c)	28. (c)	33. (a)	38. (b)	43. (c)	48. (b)
4. (b)	9. (b)	14. (a)	19. (b)	24. (c)	29. (a)	34. (b)	39. (b)	44. (c)	49. (a)
5. (a)	10. (c)	15. (b)	20. (b)	25. (c)	30. (a)	35. (b)	40. (d)	45. (c)	50. (b)

Exercise-02 Level -02 Answer Key

1. (d)	6. (d)	11. (d)	16. (a)	21. (d)	26. (a)	31. (a)	36. (a)	41. (a)	46. (a)
2. (d)	7. (d)	12. (a)	17. (d)	22. (a)	27. (a)	32. (d)	37. (a)	42. (d)	47. (d)
3. (d)	8. (d)	13. (d)	18. (c)	23. (d)	28. (a)	33. (b)	38. (d)	43. (a)	48. (d)
4. (d)	9. (c)	14. (c)	19. (b)	24. (d)	29. (d)	34. (a)	39. (a)	44. (d)	49. (a)
5. (b)	10. (a)	15. (d)	20. (a)	25. (a)	30. (b)	35. (d)	40. (d)	45. (d)	50. (d)

Exercise-03 Level -03 Answer Key

1. (b)	6. (b)	11. (b)	16. (b)	21. (c)	26. (c)	31. (b)	36. (c)	41. (b)	46. (c)
2. (a)	7. (a)	12. (a)	17. (a)	22. (c)	27. (b)	32. (b)	37. (c)	42. (a)	47. (b)
3. (b)	8. (b)	13. (a)	18. (a)	23. (c)	28. (c)	33. (c)	38. (c)	43. (d)	48. (a)
4. (a)	9. (a)	14. (a)	19. (b)	24. (a)	29. (a)	34. (a)	39. (c)	44. (d)	49. (a)
5. (a)	10. (a)	15. (b)	20. (b)	25. (a)	30. (c)	35. (c)	40. (a)	45. (b)	50. (c)

Exercise-04 Previous Year Questions

1. (b)	3. (d)	5. (b)	7. (a)	9. (d)	11. (b)	13. (d)	15. (a)
2. (c)	4. (b)	6. (c)	8. (a)	10. (d)	12. (b)	14. (c)	16. (c)