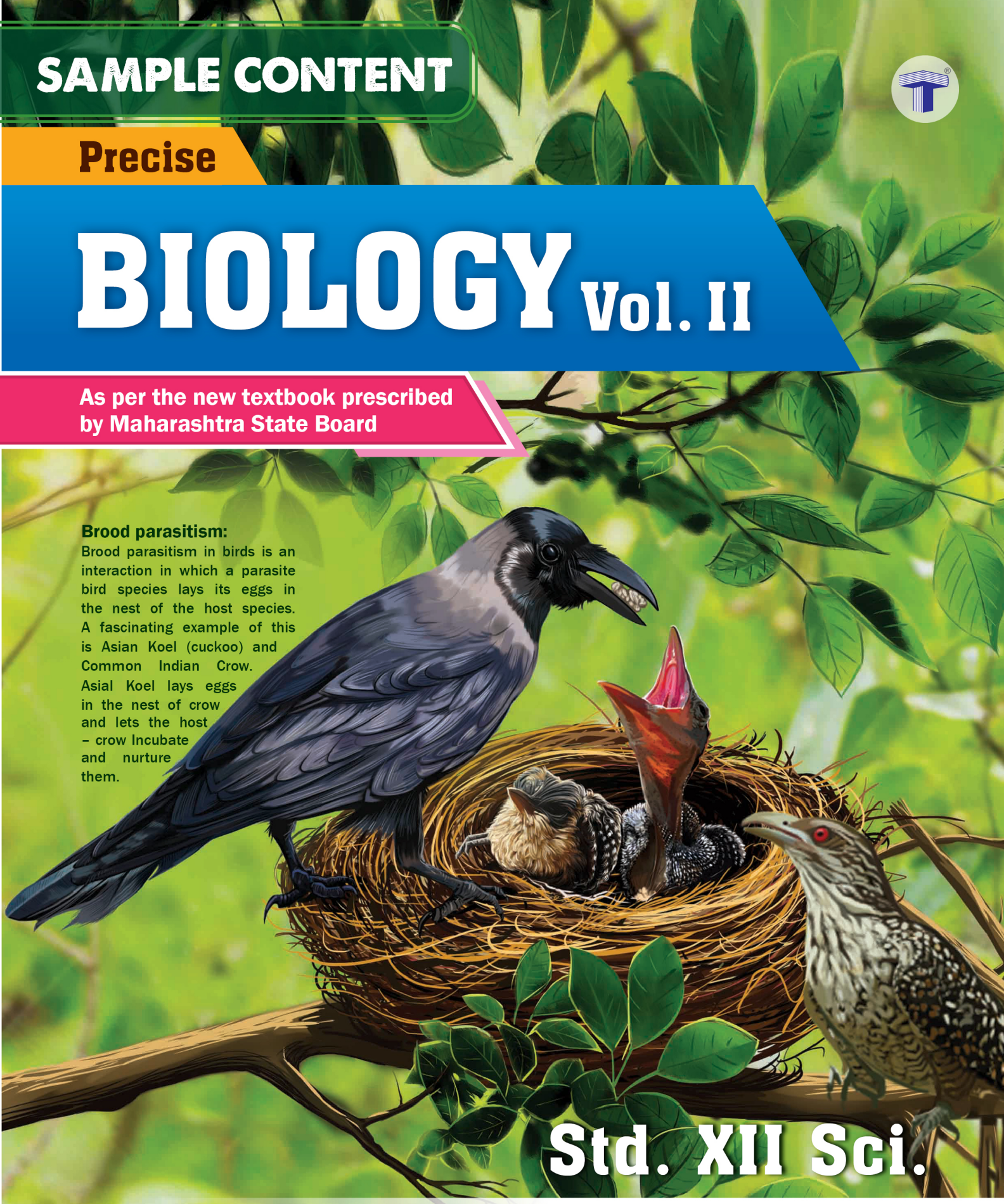
SAMPLE CONTENT

Precise

BIOLOGY Vol. II

As per the new textbook prescribed by Maharashtra State Board



Brood parasitism:
Brood parasitism in birds is an interaction in which a parasite bird species lays its eggs in the nest of the host species. A fascinating example of this is Asian Koel (cuckoo) and Common Indian Crow. Asial Koel lays eggs in the nest of crow and lets the host – crow Incubate and nurture them.

Std. XII Sci.

Target Publications® Pvt. Ltd.

Written as per the latest textbook prescribed by the Maharashtra State Bureau of Textbook Production and Curriculum Research, Pune.

Precise BIOLOGY (Vol. II)

Std. XII Sci.

Salient Features

- Written as per the new textbook
- Subtopic-wise segregation for powerful concept building
- Complete coverage of Textual Exercise Questions
- Extensive coverage of New Type of Questions
- 'Quick Review' at the end of every chapter facilitates quick revision
- Reading Between the Lines is designed to impart holistic education
- Video/PDF links provided via QR codes for boosting conceptual retention

Sample Content

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PREFACE

Precise Biology Std. XII, Vol. II is intended for every Maharashtra State Board aspirant of Std. XII, Science. The scope, sequence, and level of the book are designed to match the new textbook issued by the Maharashtra State board.

Biological systems are the supreme complex chemical systems on Earth, and their functions are both controlled and determined by the principles/laws of chemistry and physics.

We understand that Board Examinations can be daunting and the stress of cracking the examination can often leave students struggling to make sense of the curriculum.

With the examination in focus, the ***Precise Series*** has been specifically designed to make preparation easier, by providing a methodical and organized perspective of the curriculum, thus greatly improving the chance of scoring well.

In order to make sure that students fully grasp the nub of the subject, it is important to present such concepts meaningfully and in an easy to read format. In this vein, the Precise Biology book has been crafted to provide an ***exam-centric approach*** to the curriculum, while ***retaining the essence*** of the subject. Each chapter is thus structured to provide a conceptual foundation.

The scope of the book also offers a plethora of Multiple Choice Questions (MCQs) in order to familiarize the students with the pattern of competitive examinations.

We believe that the study of Biology helps in the understanding of many fascinating and important phenomena. In this vein, we have put an effort to relate Biology to real-world events in order to show students that Biology is a vibrant, constantly evolving science that has relevance in our modern world. We hope this book becomes a valuable tool for you and helps you to understand the concepts of Biology.
Please write to us on: mail@targetpublications.org

A book affects eternity; one can never tell where its influence stops.

Best of luck to all the aspirants!

From,
Publisher

Edition: First

Sample Content

Disclaimer

This reference book is transformative work based on textbook Biology; First edition: 2020 published by the Maharashtra State Bureau of Textbook Production and Curriculum Research, Pune. We the publishers are making this reference book which constitutes as fair use of textual contents which are transformed by adding and elaborating, with a view to simplify the same to enable the students to understand, memorize and reproduce the same in examinations.

This work is purely inspired upon the course work as prescribed by the Maharashtra State Bureau of Textbook Production and Curriculum Research, Pune. Every care has been taken in the publication of this reference book by the Authors while creating the contents. The Authors and the Publishers shall not be responsible for any loss or damages caused to any person on account of errors or omissions which might have crept in or disagreement of any third party on the point of view expressed in the reference book.

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FEATURES

Sub-topic wise Segregation

Every chapter is segregated sub-topic wise. A subtopic encompasses textual content in the format of Question-Answers. *Textual Exercise questions and Intext questions are placed aptly amongst various additional questions in accordance with the flow of subtopic.*
This is our attempt to enable easy assimilation of concepts and lay strong foundation for understanding as well as write answers in exam.

9.1 Nervous Co-ordination in Lower Animals

Q.1. Describe the nervous system in *Hydra*. Sketch and label the nerve net in *Hydra*.

Ans:

i. *Hydra* (Cnidarian) shows diffused type of nervous system. It is the most primitive nervous system.

ii. Nervous system of *Hydra* consists of the **sensory cells** and the **nerve cells** (neurons) along with their fibres.

Reading between the lines

Reading between the lines provides elaboration or missing fragments of the concept which is essential for complete understanding of the concept.
This is our attempt to help students to understand the underlying concept behind an answer.

Reading between the lines

Cysts and trophozoites are the infective stages of amoebiasis and are passed in feces

i. Cysts are typically found in formed stool, whereas trophozoites are typically found in diarrheal stool.
Infection by Entamoeba histolytica occurs by ingestion of mature cysts

QR Code

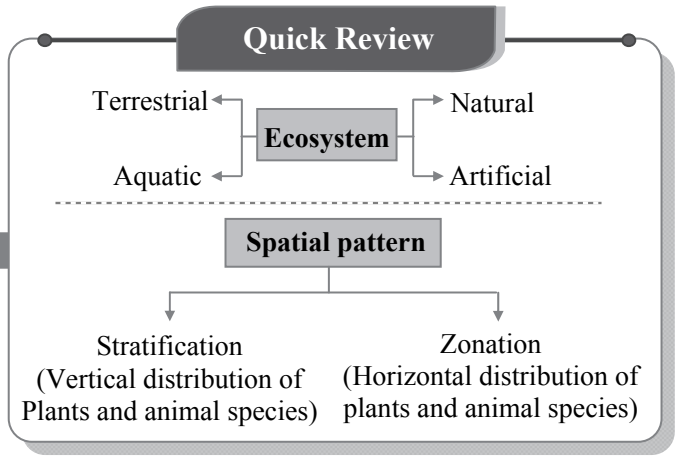
QR code provides access to a video/PDF in order to boost understanding of a concept or activity.
This is our attempt to facilitate learning through visual aids.

[Note:** Students can scan the adjacent QR code for detail information about **production of recombinant proteins

Quick Review

Quick review includes tables/ flow charts to summarize the key points in a chapter.
This is our attempt to help students to reinforce key concepts.

Quick Review



Sample Content

FEATURES

Multiple Choice Questions

2. The vertical distribution of plant species is studied in
   (A) scarification (B) stratification
   (C) zonation (D) speciation

Multiple Choice Questions

Multiple Choice Question includes textual as w[illegible] as additional MCQs.
This is our attempt to give students practice of MCQs and prepare them thoroughly for board exami[illegible]ation.

Exercise

Exercise includes subtopic-wise additional questions and problems.
This is our attempt to provide additional practice to students to gauge their preparation.

Exercise

13.0 Introduction

1. Define population and bi[illegible]me.
Ans: Population: *Re[illegible] Q.4(i)*
Biome: *Refer[illegible].3(vi)*

13.1 Organisms an[illegible]he Environment Around

2. Exp[illegible]in the t[illegible]m ni[illegible]e.
Ans: *Ref[illegible] Q.9*

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Chapter No.	Chapter Name	Page No.
9.	Control and Co-[illegible]dina[illegible]	1
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11.	Enhanc[illegible]ent of F[illegible]od Production	70
12.	Biot[illegible]chnol[illegible]y	100
13.	O[illegible]ganisms and [illegible]opulations	121
14.	Ecosystems and Energy Flow	137
15.	Biodiversity, Conservation and Environmental Issues	153

[Reference: Maharashtra State Board of Secondary and Higher Secondary Education, Pune - 04**]**

Note : 1. * mark represents Textual question.
2. # mark represents Intext question.
3. 🔔 symbol represents textual questions that need external reference for an answer.

Sample Content

13 Organisms and Populations

Contents and Concepts

13.0 Introduction
13.1 Organisms and the Environment Around
13.2 Major Abiotic Factors
13.3 Adaptation
13.4 Population
13.5 Population Interactions

13.0 Introduction

Q.1. What are the levels of organization in living world?

Ans: The levels of organization in living world are macromolecules, cells, tissues, organs, individual organism, population, communities, ecosystems and biomes.

Q.2. Define ecology. Who introduced the term ecology?

Ans:

i. Ecology is a study of the interactions among organisms and between the organisms and their physical (abiotic) environment

ii. The term ecology was introduced by E. Haeckel in 1865.

Q.3. Explain in detail the ecological hierarchy.

Ans: Ecological hierarchy:

i. The ecological grouping of organisms is known as ecological hierarchy.

ii. There are four sequential levels with increasing complexity of ecological (biological) organizations viz. Organisms, Populations, Communities and Biomes.

iii. Individual **organism** is the basic unit of ecological hierarchy.

iv. Organisms of same kind inhabiting a geographical area constitute **population**.

v. Several populations of different species in a particular area that interact with one another in several ways constitute a **community.**

vi. **Biome** constitutes a large regional terrestrial unit delimited by a specific climatic zone having major vegetation zone (plant communities) and the associated fauna.

***Q.4. Define population and community.**

Ans:

i. Population:

Organisms of same kind inhabiting a geographical area constitute population.

OR

Individuals live in groups in a well-defined geographical area, share or compete for similar resources, potentially interbreed and thus form a population.

OR

Population is defined as a group of individuals of a species occupying a definite geographic area at a given time.

ii. Community:

Several populations of different species in a particular area constitute **community** that interact with one another in several ways.

13.1 Organisms and the Environment Around

Q.5. Name the major biomes of the earth.

Ans: Desert, Grassland, Tropical forest, Temperate forest, Coniferous forest, Arctic and Alpine Tundra, etc. are the major biomes formed as a result of seasons and annual variation in precipitation.

Sample Content

Q.6. Distinguish between Habitat and Niche.

Ans:

	Habitat	Niche
i.	A habitat is an area, where a species lives and interact with the other factors and prosper.	Niche not only describes the position of a species in an environment but also describes the functional role played by an organism.
ii.	Habitat deals with effects of temperature, rainfall and other abiotic factors.	Niche deals with the flow of energy from one organism to another.
iii.	Habitat supports numerous species at a time.	Niche supports a single species at a time.
iv.	Habitat is a physical place.	Niche is an activity performed by organisms.
v.	Habitat is not species specific.	Niche is species specific.

Q.7. Write a short note on Habitat.

Ans:

i. Habitat is a place or area where a particular species lives.
ii. Habitat supports numerous species at a time.
iii. In a given habitat, factors like the sunlight, average rainfall, annual temperatures, type of soil present and other abiotic (topographic) factors affect the presence of organisms.
iv. Habitats can be arboreal, terrestrial, aerial, aquatic, etc.
e.g. Pond, river, ocean, grassland, forest, desert, etc.

Q.8. What is microhabitat?

Ans: Microhabitat is the immediate surrounding of an organism.

Q.9. Describe the term Niche.

Ans:

i. Niche not only describes the position of a species in an environment but also describes the functional role played by an organism.
ii. The term niche was coined by J. Grinell 1917.
iii. Niche is specific to each species and no two species can share the same niche.
iv. It includes various aspects of the life of an organism like diet, shelter, etc.
v. Niche deals with the flow of energy from one organism to another.
vi. Once a niche is left vacant, other organisms can fill into that position.
vii. If the species creates its own unique niche in an ecosystem, it would be helpful in reducing competition for resources among species.
viii. There are three types of niche viz. spatial or habitat niche, trophic niche, Multi-dimensional or hyper volume niche.
ix. Organisms living in same habitat differ in their niches because of different eating habitats.
e.g. Birds differ in their eating habits, as some birds eat only insects, some only fruits and some eat both and anything they come across. These birds even if live in the same habitat differ in niches as they differ in their eating habits.

Q.10. Niches are helpful in reducing competition for resources among species. Give reason.

Ans:

i. Niche is specific to each species and no two species can share the same niche.
ii. Organisms living in same habitat differ in their niches because of different eating habitats.
iii. Considering an example of birds living in same habitat, the birds show different eating habits in spite of living in same habitat as some birds eat only insects, some only fruits and some can eat both and anything they come across.
iv. This helps to prevent competition for the same source of food.

Thus, niches are helpful in reducing competition for resources among species.

Q. Explain the types of niche.

Ans: Types of niche are:

i. Spatial or habitat niche: It deals with the physical space occupied by the organisms.
ii. Trophic niche: It is based on trophic level of an organism in a food chain.
iii. Multidimensional or hypervolume niche: It considers number of environmental factors (both biotic and abiotic), the resulting space will be a hypervolume; not something that can be perceived by the human mind. This space is called the hypervolume niche. Alternatively, it is the position of an organism in the environmental gradient.

Sample Content

Q.12. What is fundamental and realized niche for a species?

Ans:

i. Fundamental niche is the niche in the absence of all competitors. It is highly improbable in nature.

ii. Realized niche is more realistic approach, in the presence of competition for the resources available in the habitat.

*[**Note:** Students can scan the adjacent QR code to get information about **fundamental and realized niche for a species.]***

13.2 Major Abiotic Factors

Q.13. Explain in detail the major abiotic factors of an ecosystem.

Ans: The abiotic factors of an ecosystem are temperature, water, light and soil.

i. Temperature:

a. It is considered the most ecologically relevant environmental factor.

b. Average temperature on land varies from subzero levels in polar areas and high altitudes, upto 50ºC in tropical deserts in summer.

c. Temperature also varies seasonally.

d. It decreases progressively from the equator towards the poles and from plains to the mountain tops.

e. There are some unique habitats such as hot springs (80 to 100ºC) and deep-sea hydrothermal vents where average temperature is usually 400ºC.

f. Ambient temperature affects the enzyme kinetics of the cell and thus, the entire metabolism, activity and other physiology of the organism.

g. **Eurythermal organisms** can tolerate and thrive in a wide range of temperatures and **stenothermal organisms** can tolerate narrow range of temperatures.

ii. Water:

a. Availability of water is an important factor affecting the organisms. The productivity and distribution of plants are also dependent on availability of water.

b. Chemical composition, temperature and pH of the water are some important factors for the survival of aquatic organisms.

c. The dissolved salt concentration (measured as salinity in parts per thousand), is less than 5ppt in fresh water of streams, lakes and rivers, and 30-35ppt in the seas and oceans. It may go up to 100ppt in some hypersaline lagoons.

d. **Euryhaline organisms** can tolerate wide range of salinities and **stenohaline organisms** can tolerate narrow range of salinities.

e. Many fresh water animals cannot survive for long in sea water and vice versa because of the osmotic problem.

iii. Light:

a. Sunlight is only source of energy for the entire ecosystem. Plants use light to perform photosynthesis.

b. Many species of small plants (herbs and shrubs) growing on forest floor are adapted to perform photosynthesis optimally under very low light conditions because they are constantly overshadowed by taller trees.

c. Light is also important for animals as they use diurnal and seasonal variations in light intensity and duration (photoperiod) as clues for timing their foraging, reproductive and migratory activities.

d. The availability of light on land is closely linked with that of temperature, since the sun is the source for both.

iv. Soil:

a. The nature and properties of soil are dependent on the climate and the weathering process.

b. Various characteristics of the soil such as soil composition, grain size, determine the percolation and water holding capacity of the soil.

c. These characteristics along with pH, mineral composition and topography, determine the vegetation of an area. Vegetation in turn dictates the type of animals.

Sample Content

Q.14. Distinguish between Ectotherms and Endotherms.

Ans:

	Ectotherms	Endotherms
i.	These are cold blooded animals.	These are warm blooded animals.
ii.	Ectotherms do not possess the ability to generate sufficient heat to keep them warm, thus their body temperature varies with surroundings.	Endotherms do possess the ability to generate heat and keep them warm, thus they can maintain constant body temperature.
iii.	They are also known as poikilothermic.	They are also known as homeothermic.
iv.	They are affected by changes in environmental temperature.	They remain unaffected by changes in environmental temperature.
	E.g. Most of the fishes, amphibians, reptiles	E.g. Birds, mammals

Q.15. If a marine fish is placed in a fresh water aquarium, will it be able to survive? Give reason.

Ans:

i. If a marine fish is placed in a freshwater aquarium, fish would not be able to survive because marine fishes are adapted to high salt concentrations of the marine environment.

ii. Marine fishes have more osmotic concentration (more salt concentration) than marine water which prevents marine water to enter into the body.

iii. When marine fish is placed in freshwater aquarium, water enters into the body of marine fish due to osmosis, as freshwater creates hypotonic environment outside the fish's body.

iv. Entry of water into body causes its body to swell leading to the death of a marine fish.

Q.16. Can you tell? *(Textbook page no. 297)*

i. What is homeostasis?

ii. Why do animals need to maintain homeostasis?

Ans:

i. Homeostasis:

An ability of organism to maintain the constancy of its internal environment despite varying external environmental conditions is called homeostasis.

ii. a. Many abiotic factors influence the habitat of an organism.

b. The abiotic factors that determine the type of habitat, show considerable diurnal and seasonal variations.

c. The plants and animals must adapt to these variations in order to survive and flourish in the habitat.

d. During the course of their evolution, many species have evolved a relatively constant 'internal' environment that permits all biochemical reactions and physiological functions to proceed with optimum rate, and allow the species to flourish.

e. Organisms need to maintain the constancy of its internal environment (homeostasis) despite variations in the external environmental conditions that tend to upset its homeostasis.

Thus, animals need to maintain homeostasis as it is important for survival of species in a habitat.

Q.17. 'To survive and flourish in any environment, organisms must adapt to the changes in the environment'. Explain the possibilities by which organisms cope up with changing environmental conditions.

Ans: Following are the possibilities by which organisms cope up with changing environmental conditions:

i. Regulate:

a. Some organisms are able to maintain homeostasis by physiological and behavioural changes which ensure constant body temperature, constant osmotic concentration, etc.

b. All birds and mammals are capable of such regulation (**thermoregulation** and **osmoregulation**).

ii. Conform:

a. Most of animals and plants cannot maintain a constant internal environment. Their body temperature changes with the ambient temperature.

b. In aquatic animals, the osmotic concentration of the body fluids changes with that of the ambient water osmotic concentration.

c. These animals and plants are simply conformers.

d. Some species have evolved the ability to regulate within a limited range of environmental conditions, beyond which they simply conform.

e. If the stressful environment is localized or only for a short period of time, the organism may migrate or suspend its activities.

Sample Content

iii. Migrate:

a. The organism can move away temporarily from the stressful habitat to a more hospitable area and return when stressful period is over.

b. Many animals, particularly birds, during winter undertake long-distance migrations to more hospitable areas.

iv. Suspend:

a. In plants, seeds serve as means to tide over periods of stress; they germinate to form new plants under favourable moisture and temperature conditions. They do so by reducing their metabolic activity and going into a state of '**dormancy**'.

b. In animals, the organism, if unable to migrate may go into **hibernation** during winter e.g. polar bear. Some snails and fish go into **aestivation** to avoid summer heat.

Q.18. How is the dormancy of seeds different from hibernation in animals?

Ans:

i. Seed dormancy is the inability of viable seeds to germinate even under suitable environmental conditions, whereas hibernation in animals is a state of reduced activities to escape cold winter conditions.

ii. During seed dormancy, growth and development of an embryo is arrested temporarily, whereas in hibernation animals enter a state of inactivity by slowing their metabolism.

Q.19. Internet my friend *(Textbook page no. 297)*

Find out the difference between hibernation and aestivation.

OR

Distinguish between hibernation and aestivation.

	Hibernation	Aestivation
i.	It is also called as winter sleep.	It is also called as summer sleep.
ii.	It is state of reduced activities in some organisms to escape cold winter conditions	It is state of reduced activities in some organisms to escape desiccation due to heat in summer.
iii.	Animals rest in warm places.	Animals rest in cool, shady and moist places.
iv.	It is shown by bear inhabiting in cold region	It is shown by some fishes and snails.

13.3 Adaptation

Q.20. Define adaptation.

Ans: Adaptation is an attribute of the organism (morphological, physiological, and behavioural) that enables the organism to survive and reproduce in its habitat.

Q.21. Do you know? *(Textbook page no. 297)*

i. Adaptations of plants for aquatic and desert habitats.

ii. Adaptations of animals for aquatic and desert habitats.

Ans:

i. Adaptations of plants for aquatic and desert habitats:

a. Adaptations of plants for aquatic habitats:

1. Leaves arrangement of some aquatic plants show presence of aerenchyma tissue which helps in exchange of gases between plant organs above the water surface and submerged plant organs.
2. Many aquatic plants have flat leaves to receive maximum sunlight for photosynthesis. Leaves of submerged plants are often dissected to minimize water resistance.
3. Roots and root hair are absent as there is no need to absorb water and the main function of root is to provide anchorage.
4. Aquatic plants in which pollination takes place by means of water, show pollen grains coated with mucilage to prevent them from wetting and decay.

b. Adaptations of plants for desert habitats:

1. Many desert plants have a thick cuticle on their leaf surfaces and have their stomata in deep pits to minimize loss of water through transpiration.
2. They show a special photosynthetic pathway (CAM - Crassulacean Acid Metabolism) that enables their stomata to remain closed during daytime.
3. Some desert plants like *Opuntia*, have their leaves reduced (modified) to spines and the photosynthetic function is taken over by the flattened stems.

ii. Adaptations of animals for aquatic and desert habitats:

a. Adaptations of animals for aquatic habitats:

1. Animals living in aquatic habitats show body stream-lined in shape, which helps to minimize water resistance and makes them easy to move in water.

Sample Content

2. Body is covered by scales. It also helps them to protect the internal soft organs of the body.
3. In fishes, locomotory organs are different types of fins like dorsal fin, ventral fin, caudal fin, pectoral fins and pelvic fins. In aquatic animals like turtles, fin like organs called paddles are present for swimming, whales have the flippers for swimming.
4. Respiratory organs are the gills in fishes.

b. Adaptations of animals for desert habitats:

1. Desert animal like Kangaroo rat inhabiting the Arizona deserts has the potential to concentrate its urine to conserve water. This animal never drinks water in its life.
2. Snakes and desert lizards bask in the sun early in the morning and burrow themselves in sand in the afternoons to escape the heat of the day, to prevent water loss.
3. Camels can store fat in the hump which can be metabolised for energy. A camel can survive for many days without water. Long eyelashes, ears lined with hair and slit like nostrils help to keep out sand.

***Q.22. Write a short note on**

i. Adaptations of desert animals

ii. Adaptations of plants to water scarcity

iii. Behavioural adaptations in animals.

Ans:

i. Adaptations of desert animals: *Refer Q.21(ii-b)*

ii. Adaptations of plants to water scarcity: *Refer Q.21(i-b)*

iii. Behavioural adaptations in animals.

a. To cope up with extreme variations in their environment, some organisms respond through behaviourally (like migration, hibernation, and aestivation).
b. For e.g. Desert lizards manage to keep their body temperature fairly constant by behavioural adaptations.
c. They bask in the sun and absorb heat, when their body temperature drops below the comfort zone. But when the ambient temperature starts increasing they move in the shade.
d. Some species burrow into the sand to hide and escape from the heat.

Q.23. How are mammals from Polar regions adapted to cold climate?

Ans:

i. Mammals from colder climates generally have shorter snout, ears, tail and limbs to minimize the loss of body heat (Allen's Rule.)
ii. In polar region, aquatic mammals like seals have a thick layer of fat (blubber) below their skin acting as an insulator to reduce loss of body heat.

Q.24. Can you tell? *(Textbook page no. 297)*

What are the adaptations in animals living under crushing pressure at great depths of ocean?

Ans:

i. Organisms living at great depths of ocean are largely made up water and water is incompressible thus; these organisms can survive at great depth and withstand crushing pressure.
ii. Aquatic creatures living in great depths do not have gas filled spaces like lungs or swim bladders that can be compressed due to pressure.
iii. Diving to depth can result in mechanical distortion and tissue compression, especially in gas-filled spaces in the body. Such spaces include the middle ear cavity, air sinuses in the head, and the lungs. Development of even small pressure differentials between an air cavity and its surrounding tissue can result in tissue distortion and disruption a condition known as squeeze.
iv. In some species of cetaceans(aquatic group of mammals), the middle ear cavity is lined with an extensive venous plexus, which is postulated to become engorged at depth and thus reduce or obliterate the air space and prevent development of the squeeze.
v. Cetaceans also have large Eustachian tubes communicating with the tympanic cavity of the ear and the large pterygoid sinuses of the head. These air sinuses of the head have an extensive vasculature, which is thought to function in a manner similar to that of the middle ear and facilitate equilibration of air pressure within these spaces.
vi. In deep-diving whales and seals, the peripheral airways are reinforced, and it is postulated that this allows the lungs to collapse during travel to depth.
vii. In organisms living at depths, lungs cannot serve as a source of oxygen during the dive. Instead they rely on large oxygen stores in their blood and muscle.

[Source :** https://www.scientificamerican.com/article/how-do-deep-diving-sea-cr/**]

Sample Content

13.4 Population

Q.25. What is population ecology?

Ans: Population ecology an important area of ecology that links ecology to population dynamics, genetics and evolution.

***Q.26. Enlist and explain the important characteristics of a population.**

Ans:

i. The important characteristics of a population are population size, population density, natality, mortality, sex ratio, immigration, emigration, age pyramids, expanding population, population growth forms and biotic potential.

ii. Some important characteristics of population are:

a. Population density:

Population density tells us the number of individuals present per unit space, in a given time.

OR

Density of a population is the total number of individuals in that population present per unit area at a specific time.

b. Natality: Natality is the birth rate of a population.

c. Mortality: Mortality is the death rate of a population.

d. Age distribution and Age pyramids:

1. A population consists of individuals with different ages. The entire population is divided into three age groups - **pre-reproductive** (0-14 years)**, reproductive** (15-45 years), **post reproductive** (45-85+years)The relative proportion of individuals of various age groups in the population is referred to as age structure of the population.
2. If the age distribution (per cent individuals of a given age or age group) is plotted for the population, the resulting structure is called as age pyramid.

e. Sex Ratio: Sex ratio is the ratio of the number of individuals of one sex to that of the other sex.

Reading between the lines

Other characteristics of population:

i. Population size: *It is the number of individuals in a population.*

ii. Immigration:

a. In immigration, new individuals come into the population from outside.

b. It results in increase in the population density.

iii. Emigration:

a. In emigration, individuals leave the population and move out.

b. It results in decrease in population density.

iv. Expanding population: *A population having larger number of individuals of the pre-reproductive age groups shows a very rapid growth rate. This is known as a expanding population.*

v. Population growth forms: *When resources in the habitat are unlimited, population show **exponential** growth.*

*When resources in the habitat are limited, it leads to competition between individuals for limited resources. This type of population growth is called **logistic** growth.*

vi. Biotic potential: *Biotic potential is the maximum reproductive capacity of a population under optimum environmental conditions. Biotic potential of population is restricted because of limiting factors such as disease, predation, and restricted food resources.*

Q.27. Explain the terms Natality and Mortality in detail.

Ans:

i. Natality:

a. Natality is the birth rate of a population. It has the greatest influence on a population's growth.

b. Natality is a crude birth rate or specific birth rate.

c. **Crude birth rate** is used while calculating population size (number of births per 1000 population/year), whereas **specific birth rate** is used relative to a specific criterion such as age.
E.g. If in a pond, there were 200 carp fishes last year and through reproduction 800 new fishes are added, taking the current population to 1000, thus the birth rate can be calculated as 800/200 = 4 offspring per carp per year.

Sample Content

d. **Absolute Natality:** The number of births under ideal conditions (with no competition, abundance of resources such as food and water, etc.).
e. **Realized Natality:** The number of births when environmental pressures come into play.
f. Absolute natality will be always more than realized natality.

ii. Mortality:

a. Mortality is the death rate of a population.
b. Mortality rate or death rate is a measure of the number of deaths (in general, or due to a specific cause) in a particular population, in proportion to the size of that population, per unit of time.
c. Mortality rate is typically expressed in deaths per 1,000 individuals per year.
Thus, a mortality rate of 9.5 (out of 1,000) in a population of 1,000 would mean 9.5 deaths per year in that entire population, or 0.95% out of the total.
d. **Absolute Mortality:** The number of deaths under ideal conditions (with no competition, abundance of resources such as food and water, etc.).
e. **Realized Mortality:** The number of deaths when environmental pressures come into play.
f. It must be remembered that absolute mortality will be always less than realized mortality.

Q.28. Write a short note on sex ratio.

Ans: Sex ratio:

i. Sex ratio is the ratio of the number of individuals of one sex to that of the other sex.
ii. The males and females in a ratio of 1:1 is generally the most common evolutionary stable strategy (ESS).
iii. The sex ratio of the population affects and is reciprocally affected by birth, death, immigration, and emigration rates.

Q.29. What is age distribution and age pyramid?

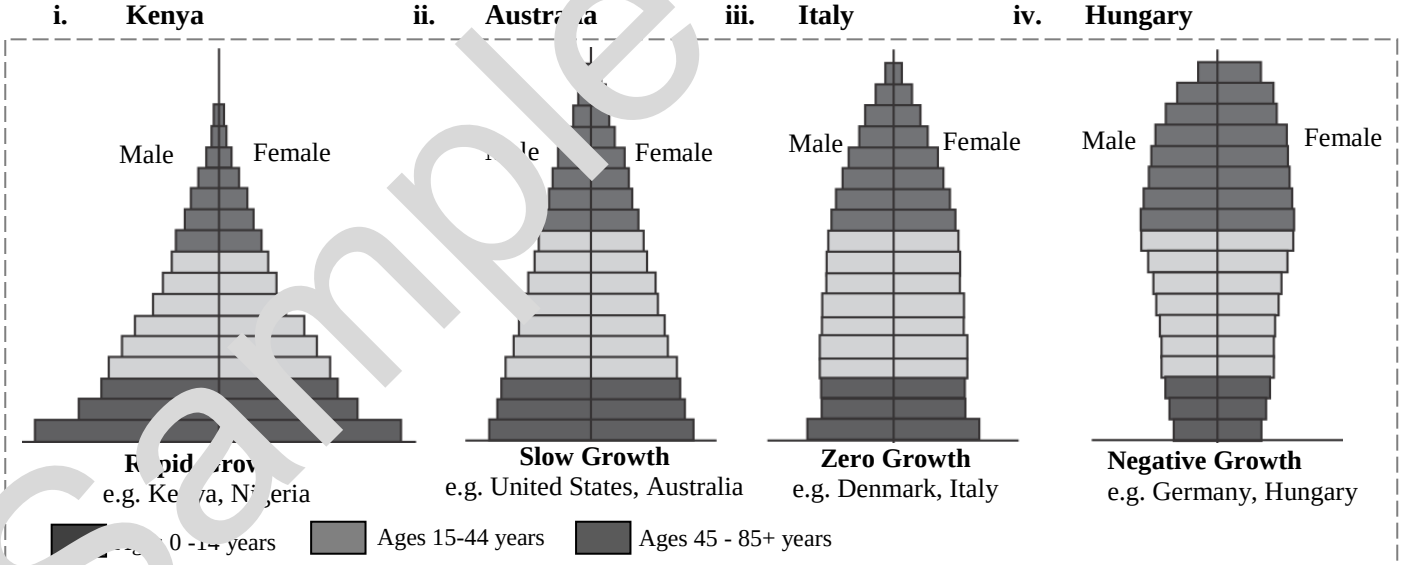
Ans:

i. **Age distribution** is the per cent individuals of a given age or age group in a given population.
ii. For e.g. the entire human population can be divided into three age groups as Pre-Reproductive (age 0-14 years), Reproductive (age 15-44 years) and Post- reproductive (45-85+ years).
iii. If the age distribution is plotted for the population, the resulting structure is called an **age pyramid.**

Q.30. Use your brain power *(Textbook page no. 299)*

From the age pyramids given below what will be your forecast for 15 years from now for the populations of

i. Kenya ii. Australia iii. Italy iv. Hungary



Age pyramids for countries with rapid, slow, zero and negative population growth rates.

[Note:** Students are expected to scan the given Q.R code to get information about age pyramids.**]

Q.31. What is population size?

Ans: Population size is the number of individuals in a population.

Sample Content

Q.32. 'Measuring population density in terms of number is sometimes meaningless or difficult to determine.' Explain with examples how population density is determined in such cases.

Ans:

i. Population size, more technically called population density (designated as N), need not necessarily be measured in numbers only.

ii. Although the total number of individuals of a species provides the most appropriate measure of its population density, in some cases, measuring population density in terms of numbers is either meaningless or difficult to determine.

iii. In an area there are millions of termites / ants but only a few animals which feed on them. Thus it cannot be stated that density of these predator is low. In this case, biomass can be a more appropriate measure of population size.

iv. If the population is huge then counting the total numbers becomes impossible and also time consuming. In such cases, there is no need to know the absolute population densities; relative densities serve the purpose equally well. For instance, the number of birds / insects caught per trap is good enough measure of their total population density. The tiger census in our national parks and tiger reserves is often based on pug marks and faecal pellets.

Q.33. Describe the basic processes that determine population density. Also give the equation for population density.

Ans:

i. The basic processes that determine the population density are New births (B), Immigration (I), Deaths (D) and Emigration (E).

ii. Natality is the birth rate of a population and mortality is the death rate of a population.

iii. Immigration (I) is the number of individuals of the same species that have come into the habitat from elsewhere during the time period under consideration.

iv. Emigration (E) is the number of individuals of the population who left the habitat during the time period.

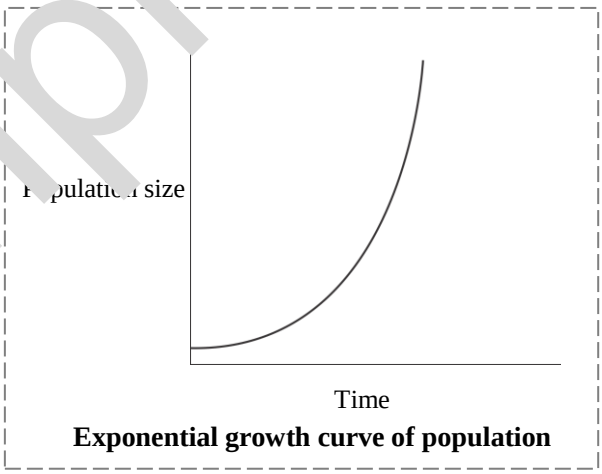
v. Natality or New births (B) and Immigration (I) contribute to an increase in population density and mortality or Deaths (D) and emigration (E) lead to decrease in population density.

vi. Population density (N) at time 't', then its density at time 't + 1' can be calculated as,

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

Q.34. Explain in detail exponential growth curve of population.

Ans:



Exponential growth curve of population

i. Resources like food, space are essential for any growth of a population.

ii. Ideally, when resources in the habitat are unlimited, each species has the ability to fully realize its innate potential to grow in numbers. Then the population grows in an exponential or geometric proportion.

iii. Every species is capable of growing exponentially under unlimited resource conditions, and reach enormous population densities in a short time.

iv. Darwin showed how even a slow growing animal could reach enormous numbers (provided food and space remain unlimited).

Sample Content

***Q.35. With the help of suitable diagram describe the logistic population growth curve.**

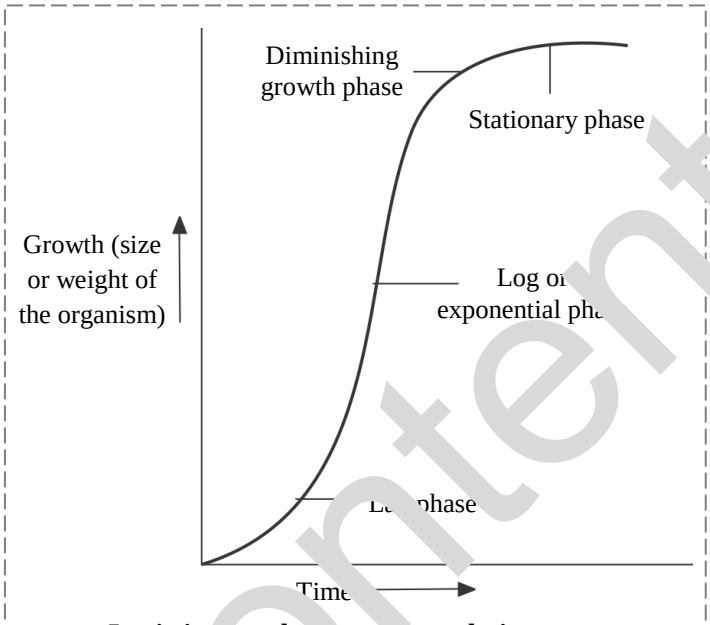
Ans:

i. Resources like food and space are not always unlimited. They may be plenty in the beginning; but as the population density increases, competition for those resources starts, resulting in slowdown in the rate at which the original population was growing. This results in logistic or sigmoid growth curve.

ii. Competition between individuals for limited resources will weed out the 'weaker' ones. Only the 'fittest' individuals will survive and reproduce.

iii. A given habitat has enough resources to support a maximum possible number, beyond which no further growth is possible. This limit can be called as nature's **carrying capacity** (K) for that species in that habitat.

iv. A population growing in a habitat with limited resources show initially a lag phase, followed by phases of acceleration and deceleration and finally an asymptote, when the population density reaches the carrying capacity.



Logistic growth curve of population

v. A plot of population density (N) in relation to time (t) results in a sigmoid curve. This type of population growth is called Verhulst-Pearl Logistic Growth.

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

13.5 Population Interactions

Q.36. Write a short note on population interaction.

Ans: Population interaction:

i. In nature, animals, plants and microbes cannot and cannot live in isolation. They interact in myriad ways to form a biological community.

ii. These interactions can be **intraspecific** i.e. existing between organisms of same population, and **interspecific** i.e. between members of different species.

iii. Inter-specific interactions occur between minimum two organisms which can be plants or animals or plant and animal.

iv. Even in simple communities, many interactions exist, however not all can be observed easily.

v. Such interaction may be classified as four types viz, neutralism, negative (harmful), positive (beneficial), and both positive and negative interactions.

vi. These interactions could be beneficial, detrimental or neutral (neither harm nor benefit) to one of the species or both.

vii. The various types of interactions are classified as per the nature of these interactions to one or both the species for e.g. **mutualism**, **competition**, **parasitism**, **predation**, **commensalism**, **amensalism**, etc.

Q.37. Identify 'P', 'Q', 'R', 'S' in the given table representing interspecific interactions.
[In the given table, 'O': not affected; '+': benefited; '–' : inhibited(harmed)]

No	Types of interactions with subdivision		Species	
			A	B
i.	Neutralism - no significant effect		**'P'**	O
ii.	Negative interactions	a. Competition : direct interference type	–	–
		b. Competition : resource - use type	–	–
		c. **'Q'**	–	O
iii.	Positive interactions	a. Symbiosis (Mutualism)	+	+
		b. **'R'**	+	O
		c. Protocooperation	+	+

Sample Content

iv.	Both positive and negative interactions	a. Parasitism	+	–
		b. **'S'**	+	–

Ans: P: O; Q: Amensalism; R: Commensalism; S: Predation

Q.38. Match the following.

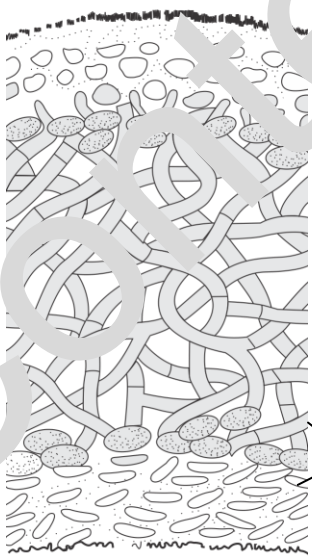
	Column I		Column I
a.	Mutualism	i.	Both the species are harmed
b.	Commensalism	ii.	One species is harmed whereas the other is unaffected.
c.	Competition	iii.	Both the species are benefited
d.	Amensalism	iv.	One species is benefitted and the other is neither benefitted nor harmed

Ans: (a-iii), (b-iv), (c-i), (d-ii)

Q.39. Observe the given figure and explain in detail the type of interaction shown by its components.

Ans:

i. The given figure represents V.T.S.(Vertical Transverse Section) of thallus of lichen showing algal and fungal components. The interaction shown by algal and fungal component of lichen is **Mutualism**.
ii. This interaction is obligatory and interdependent.
iii. In this type of interaction, both species - alga and lichen are benefited.
iv. Lichens represent an intimate, mutualistic relationship between a fungus and photosynthetic algae or cyanobacteria.
v. Alga performs photosynthesis, whereas fungus absorbs moisture.



V. T. S. of Lichen thallus showing Algal and fungal components

Q.40. Explain in detail the type of interaction in which both the species are harmed.

Ans:

i. **Competition** is the type of interaction where both the species are harmed.
ii. Totally unrelated species may compete for the same resource e.g. in shallow creeks on the west coast of Mumbai, visiting flamingos and resident fish compete for their common food, the zooplankton.
iii. However, resources need not always be limiting for competition to occur. In competition, the feeding efficiency of one species is reduced due to the interference or inhibitory presence of the other species, even if resources (food and space) are abundant, e.g. Leopards do not hunt in close proximity of lion pride.
iv. Therefore, competition is best defined as a process in which the fitness of one species is significantly lower in the presence of another species.
v. Some species evolve mechanism called 'resource partitioning' which promotes co-existence of both species rather than exclusion.
vi. A species whose distribution is restricted to a small geographical area because of the presence of a competitively superior species, is found to expand its range when the competing species is removed.

Q.41. State the Gause's 'Competitive Exclusion Principle'.

Ans: Gause's 'Competitive Exclusion Principle' states that two closely related species competing for the same resources cannot coexist indefinitely and the competitively inferior one will be eliminated eventually.

Q.42. What is resource partitioning mechanism?

Ans:

i. In interspecific competition with sufficient resources, species facing competition will evolve mechanism called 'resource partitioning'.
ii. If two species compete for the same resource, they could avoid competition by choosing different times for feeding.

Sample Content

iii. It promotes co-existence of both species rather than exclusion.

*[**Note:** Students can scan the adjacent QR code to get information about **Resource partitioning.]***

***Q.43. Give one example for each: i. Mutualism ii. Interspecific competition**

Ans:

i. Mutualism: E.g. Lichens represent an intimate, mutualistic relationship between a fungus and photosynthetic algae or cyanobacteria.

ii. Interspecific competition:

E.g. Competition between leopards and lion, resident fish competing with migratory birds Flamingos for common food i.e. zooplankton *[Any one example]*

Q.44. Explain the term Parasitism with respect to endoparasites and ectoparasites.

Ans: Parasitism:

i. In parasitism, only one species (parasite) is benefited and the interaction is detrimental to other species (host).

ii. Parasitism has evolved in so many taxonomic groups from plants to higher vertebrates.

iii. Many parasites have evolved to be host-specific (they can parasitize only a single species of host) in such a way that both host and the parasite tend to co-evolve, against each other.

iv. In accordance with their life styles, **endoparasites** evolved special adaptations such as the loss of unnecessary sense organs, presence of adhesive organs or suckers to cling onto the host, loss of digestive system and high reproductive capacity.

v. The life cycles of parasites are often complex involving intermediate hosts or vectors to facilitate transfer to the host. For e.g. The malarial parasite *Plasmodium vivax* needs a vector (mosquito) to spread to other hosts.

vi. Majority of the parasites harm the host. They may reduce the survival, growth and reproduction of the host and may lead to death of the host, thus reducing its population density.
They might render the host more vulnerable to predation by making it physically weak.

vii. Parasites that feed on the external surface of the host organism are called **ectoparasites**. The most familiar examples of this group are the lice on humans and ticks on dogs.
Many marine fishes are infested with ectoparasitic copepods. .
Cuscuta, a parasitic plant that is commonly found growing on hedge plants, has lost its chlorophyll and leaves in the course of evolution. It derives its nutrition from the host plant which it parasitizes.

Q.45. Use your brain power *(Textbook page no.303)*

i. Should an ideal parasite be able to thrive within the host without harming it?

ii. Why didn't natural selection lead to the evolution of such totally harmless parasites?

Ans:

i. a. Parasitism is an interaction in which one species is benefitted at the expense of other.
b. Parasites are always harmful. Majority of parasites harm their hosts for various necessities like food, shelter, or completing their life cycle,etc.
c. There are organisms which thrive within the host without harming it but they are not called ideal parasites.
d. If parasite is able to derive benefit without harming its host, then such interactions would be commensalism and not parasitism.

ii. Natural selection did not lead to the evolution of such totally harmless parasites because if the parasites become totally harmless then they will be commensals and not parasites.

Q.46. Which type of population interaction is shown in given picture?

Ans: The given picture represents **Brood parasitism.**

i. Brood parasitism in birds is a fascinating example, in which the parasitic bird lays its eggs in the nest of its host bird and lets the host bird incubate them.

ii. During the course of evolution, the eggs of the parasitic bird have evolved to resemble the host's egg in size and colour to reduce the chances of the host bird detecting the foreign eggs and ejecting them from the nest.

iii. Eggs of the parasitic bird (Asian koel) hatch before that of its host (Common Indian crow).

Sample Content

***Q.47. Distinguish between: Parasitism and Mutualism**

Ans:

	Parasitism	Mutualism
i.	In parasitism only one species (parasite) is benefited and the interaction is detrimental to other species (host).	In mutualism both species are benefited.
ii.	Parasite need host, but host does not need the parasite.	Both the species need presence of each other.
E.g.	*Cuscuta*, a parasitic plant commonly found growing on hedge plants.	Lichen represents mutualistic relationship between a fungus and photosynthetic algae or cyanobacteria.

Q.48. 'Predators in nature are prudent.' Explain the given statement with suitable examples.

Ans:

i. In the balanced ecosystem, the population of prey and predator species ensure that their populations are controlled by each other.

ii. Predators keep prey populations under control. Without them, prey species would reach very high population densities and cause ecosystem instability. For e.g. in absence of frogs, locusts increase in density and destroy large tracts of agricultural lands.

iii. In biological control, methods adopted in agricultural pest control are based on the ability of the predator to regulate prey population.

iv. Predators also help in maintaining species diversity in a community, by reducing the intensity of competition among competing prey species.

v. When certain exotic species are introduced accidentally or intentionally into a new geographical area, they become invasive and start spreading rapidly due to absence of natural predator, e. g. Zebra mussels in the intertidal zone of North America.

vi. If a predator over-exploits its prey, then the prey might become extinct and following it, the predator will also become extinct for lack of food.

Thus, predators in nature are 'prudent'.

***Q.49. What is the ecological process behind the biological control method of managing with pest insects?**

Ans: The ecological process behind the biological control method of managing with pest insects is **Predation.**

Predators regulate the population of preys in a habitat thus helping in the management of pest insects.

Q.50. Explain with examples how animal and plants species have evolved defenses to reduce the impact of predation.

Ans: Prey species have evolved various defenses to reduce the impact of predation.

i. Better camouflage for concealment, faster speed for escape are some defense mechanisms developed by the prey and the predator has to counter these by its own means.

ii. Some species of insects and frogs are cryptically coloured (camouflaged) to avoid being detected easily.

iii. The Monarch butterfly is highly distasteful to predator (bird) because of a special chemical present in its body. The Monarch butterfly acquires the chemical during its caterpillar stage by feeding on a poisonous weed.

iv. For plants, herbivores are predators, thus plants have evolved variety of morphological and chemical defenses against herbivores.

v. Thorns (*Acacia*, *Cactus*) are the most common morphological means of defense.

vi. Many plants produce and store chemicals that make the herbivore sick. When chemicals are eaten, they inhibit feeding or digestion of predator and disrupt reproduction or even kill it.

vii. *Calotropis* grown in abandoned fields, produces highly poisonous cardiac glycosides and due to which cattle or goats never been browsing on this plant.

viii. A wide variety of chemical substances that we extract from plants on a commercial scale, (for e.g.nicotine, caffeine, quinine, strychnine, opium, etc.,) are secondary metabolites produced by them actually as defences against herbivores and browsers.

Q.51. Name important defense mechanisms in plants against herbivores.

Ans: Defense mechanisms in plants against herbivores can be morphological like **thorns** (in *Acacia*, *Cactus*) or chemicals like poisonous **cardiac glycosides** (produced by *Calotropis*), **secondary metabolites** (for e.g. nicotine, caffeine, quinine, strychnine, opium, etc.)

Q.52. Which type of ecological interaction is shown in given pictures? Explain it by giving examples.

Sample Content

Ans:

i. The type of ecological interaction shown in the given pictures is **Commensalism**.
ii. This is the interaction in which one species benefits and the other is neither harmed nor benefited.
iii. An orchid growing as an epiphyte on a branch of mango tree, will get benefit while the mango tree derives no benefit.
iv. The cattle egret and grazing cattle in close association, is a classic example of commensalism. Cattle egrets always forage close to cattle, as cattle move they flush out insects that might be difficult for the egret to find and catch.
v. Another example of commensalism is 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.

***Q.53. An orchid plant is growing on the branch of mango tree. How do you describe this interaction between the orchid and the mango tree?**

Ans:

i. An orchid plant is growing on the branch of mango tree represents **Commensalism**.
ii. In this interaction, one species gets benefited and the other is neither harmed nor benefited.
iii. Orchid is an epiphytic plant. While growing on mango tree it gets support, but does not derive any nutrition from mango tree.
iv. Thus, orchid plant is benefited, while the mango tree is neither benefited nor harmed.

***Q.54. Define following terms:**

i. Commensalism ii. Parasitism iii. Camouflage

Ans:

i. Commensalism: Commensalism is the interaction in which one species gets benefited and the other is neither harmed nor benefited.
ii. Parasitism: Parasitism is the interaction in which only one species (parasite) is benefited and the interaction is detrimental to other species (host).
iii. Camouflage: Camouflage is the cryptic coloration or pattern adapted by prey species to blend with the surroundings or background so as to escape their predators.

***Q.55. Name the type of association:**

i. Clown fish and sea anemone ii. Crow feeding the hatchling of Koel
iii. Humming birds and host flowering plants

Ans:

i. Clown fish and sea anemone: **Commensalism**
ii. Crow feeding the hatchling of Koel: **Brood parasitism**
iii. Humming birds and host flowering plants: **Mutualism**

Practical / Project

***Q. 56. Study the age pyramid of human population in your area.**

Ans: Age pyramid: A population is divided into various age groups**,** therefore in order to study age pyramid in an area the following age groups should be considered: pre-reproductive (0-14 years), reproductive(15-44 years), post-reproductive(45-85 years) age groups.

[Note: Students can refer the above information and attempt this activity on their own.]

Quick Review

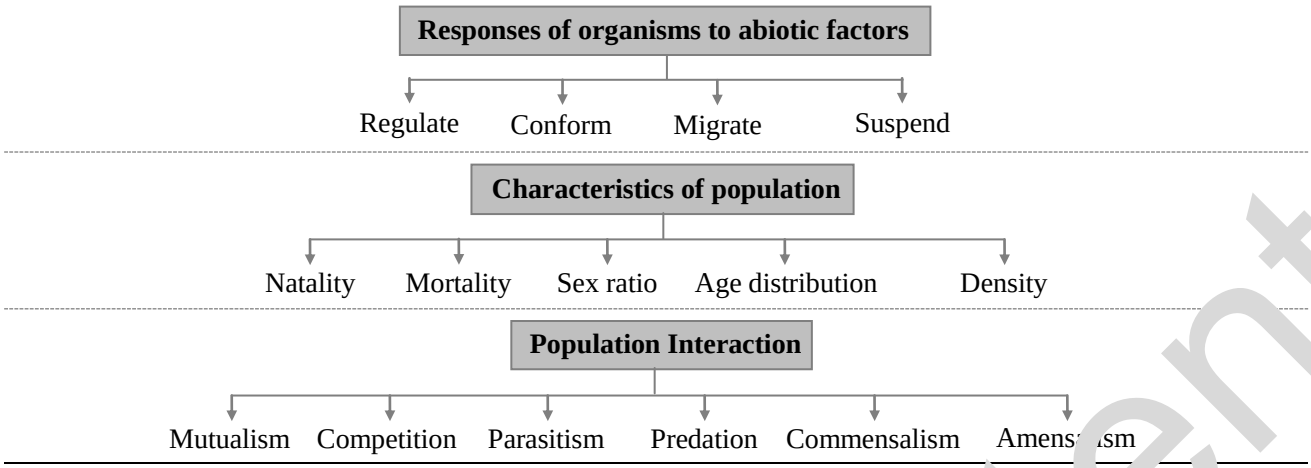
Ecological Hierarchy

Organism → Population → Community → Ecosystem → Biome

Abiotic factors influencing habitat

Water, Light, Temperature, Soil

Sample Content



Exercise

13.0 Introduction

1. Define population and biome.
Ans: Population**:** *Refer Q.4(i)*
Biome: *Refer Q.3(vi)*

13.1 Organisms and the Environment Around

2. Explain the term niche.
Ans: *Refer Q.9*

3. Elaborate on habitat.
Ans: *Refer Q.7*

4. Describe hypervolume niche.
Ans: *Refer Q.11(iii)*

5. Distinguish between habitat and niche
Ans: *Refer Q.6*

13.2 Major Abiotic Factors

6. Explain temperature as one of the major abiotic factor that influences any habitat.
Ans: *Refer Q.13(i)*

7. What are conformers?
Ans: *Refer Q.17(ii)*

8. What are euryhaline and stenohaline organisms?
Ans: *Refer Q.15(c,d)*

9. What are the characteristics of soil that determine vegetation of an area?
Ans: *Refer Q.13(b,c)*

10. How are thermal organisms are different from stenothermal organisms?
Ans: *Refer Q.13 (i-g)*

11. Define homeostasis. Why is homeostasis important for survival of any species in a habitat?
Ans: *Refer Q.16.*

12. Explain how light an important factor for plant and animals.
Ans: *Refer Q.13(iii)*

13. How hibernation differs from aestivation?
Ans: *Refer Q.19*

14. Explain the ways by which organisms adapt to survive and flourish in response to abiotic factors.
Ans: *Refer Q.17*

13.3 Adaptation

15. Explain the adaptations in desert plants.
Ans: *Refer Q.21(b)*

16. What are the adaptations shown by aquatic mammals in polar regions?
Ans: *Refer Q.21(i)*

17. Describe the behavioural adaptation shown by desert lizard.
Ans: *Refer Q.22(iii)*

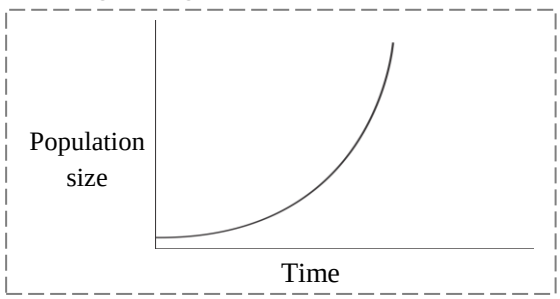
13.4 Population

18. Enlist the characteristics of population.
Ans: *Refer Q.26(i)*

19. Define natality and mortality.
Ans: Natality :*Refer Q.26(ii-b)*
Mortality: *Refer Q.26(ii-c)*

20. On what basis tiger census is done in our national parks?
Ans: *Refer Q.32(iv)*

21. Explain the growth curve of population shown in the given figure.



Ans: *Refer Q.34*

22. Write a short note sex ratio.
Ans: *Refer Q.28*

23. Which are the major age groups in a human population?
Ans: *Refer Q.29(ii)*

Sample Content

24. Define immigration and emigration.
Ans: Immigration: *Refer Q.33(iii)*
Emigration: *Refer Q.33(iv)*

25. Write an equation to calculate population density at time t+1.
Ans: *Refer Q.33(vi)*

26. Explain Logistic growth in detail.
Ans: *Refer Q.35*

13.5 Population Interactions

27. i. Define parasitism.
ii. Give examples of ectoparasites.
Ans: i. *Refer Q.44(i)* ii. *Refer Q.44(vii)*

28. Identify and describe the interaction shown in the given picture.

Ans: *Refer Q.52*

29. Define:
i. Intraspecific competition
ii. Interspecific competition
Ans: i. Intraspecific competition: *Refer Q.36(i)*
ii. Interspecific competition: *Refer Q.36(iii)*

30. Explain mutualism with example.
Ans: *Refer Q.39*

31. Write a short note on brood parasitism.
Ans: *Refer Q.46*

32. How plants show morphological and chemical defenses against herbivores
Ans: *Refer Q.50(v-viii)*

33. How monarch butterflies protect themselves from predators?
Ans: *Refer Q.50(i)*

Multiple Choice Questions

*1. A assemblage of individuals of different species living in the same habitat and having functional interactions is
(A) Biotic community (B) Ecological niche
(C) Population (D) Ecosystem

*2. Which factor of an ecosystem includes plants, animals and microorganisms?
(A) Biotic factor (B) Abiotic factor
(C) Direct factor (D) Indirect factor

3. The organisms that can tolerate and thrive in a wide range of temperatures are called as
(A) Stenothermal (B) Euryhaline
(C) Eurythermal (D) Stenohaline

4. The state in which seeds do not germinate and reduce their metabolic activity is called
(A) Hibernation (B) Aestivation
(C) Dormancy (D) Mutualism

5. Adaptation shown by desert lizard to keep their body temperature fairly constant is an example of _____ adaptation.
(A) morphological (B) behavioural
(C) physiological (D) none of these

6. Population density increases when
(A) Deaths and emigration increases
(B) Birth and immigration increases
(C) Natality equals mortality
(D) Mortality is more than natality

*7. Growth of bacteria in a newly inoculated agar plate shows
(A) exponential growth
(B) logistic growth
(C) Verhulst-Pearl logistic growth
(D) zero growth

8. Association between sea anemone and Hermit crab in gastropod shell is that of
(A) Mutualism (B) Commensalism
(C) Parasitism (D) Amensalism

9. Lichens represent _____ relation between fungi and photosynthetic algae.
(A) Mutualistic (B) parasitic
(C) predatory (D) negative

*10. Select the statement which explains best parasitism.
(A) One species is benefited.
(B) Both the species are benefited.
(C) One species is benefited, other is not affected.
(D) One species is benefited, other is harmed.

11. Which of the following is NOT an example of predation?
(A) sparrow eating seeds
(B) orchid growing on mango tree
(C) frogs eating locust
(D) lion chasing deer

12. The cattle egret and grazing cattle in close association is a classic example of
(A) Ectoparasitism (B) Commensalism
(C) Predation (D) Competition

Answers to Multiple Choice Questions

1.	(A)	2.	(A)	3.	(C)	4.	(C)
5.	(B)	6.	(B)	7.	(A)	8.	(B)
9.	(A)	10.	(D)	11.	(B)	12.	(B)

Sample Content

Std. XII

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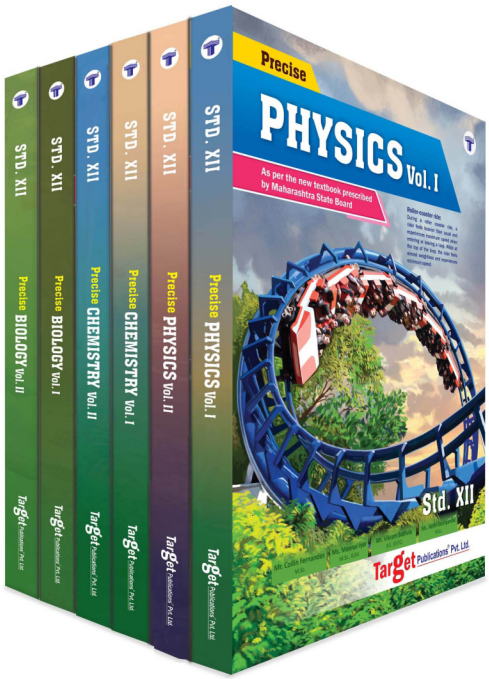

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