Class: 12th

Subject: Biology

Chapter 25: ECOSYSTEM

Important MCQs:

1. The term ecology is derived from the Greek words oikos and logy. What do they mean respectively?

(a) Home and study ✅

(b) Life and nature

(c) Earth and system

(d) Species and community

2. The term ecology was first coined by:

(a) Charles Darwin

(b) Ernst Haeckel ✅

(c) Joseph Grinnell

(d) Charles Elton

3. Ernst Haeckel coined the term oecologic in the year:

(a) 1860

(b) 1866 ✅

(c) 1872

(d) 1880

4. Ecology is defined as the study of:

(a) Evolution of species

(b) Structure of organisms

(c) Relationship of organisms with their environment ✅

(d) Chemical composition of organisms

5. The major unit of ecology is called the:

(a) Population

(b) Community

(c) Ecosystem ✅

(d) Biosphere

6. The biotic components of an ecosystem include:

(a) Soil and water

(b) Climate and atmosphere

(c) Plants, animals, and microorganisms ✅

(d) Light and temperature

7. The abiotic components of an ecosystem include:

(a) Fungi and bacteria

(b) Plants and animals

(c) Soil, water, and air ✅

(d) Population and community

8. A population is defined as:

(a) A group of different species in an area

(b) A group of interbreeding individuals of the same species ✅

(c) A collection of ecosystems

(d) A group of abiotic factors

9. All populations living in an ecosystem make up a:

(a) Community ✅

(b) Biosphere

(c) Habitat

(d) Niche

10. Populations competing for resources such as food or space is an example of:

(a) Cooperation

(b) Symbiosis

(c) Competition ✅

(d) Mutualism

11. The major types of ecosystems that occupy broad geographical regions are called:

(a) Populations

(b) Biomes ✅

(c) Communities

(d) Niches

12. The combination of all Earth's biomes forms the:

(a) Habitat

(b) Biosphere ✅

(c) Population

(d) Ecosystem

13. The biosphere is:

(a) The solid part of the Earth

(b) A thin layer of Earth where life exists ✅

(c) The upper atmosphere

(d) A type of biome

14. The actual place where an organism lives is known as its:

(a) Niche

(b) Biome

(c) Habitat ✅

(d) Community

15. The term niche was first proposed by:

(a) Ernst Haeckel

(b) Joseph Grinnell ✅

(c) Charles Elton

(d) Charles Darwin

16. According to Charles Elton, the niche of an organism refers to:

(a) Its physical location

(b) Its occupation or role in the community ✅

(c) Its reproductive pattern

(d) Its population size

17. A niche includes:

(a) Only the physical factors

(b) Only the feeding behavior

(c) All biotic and abiotic interactions necessary for survival ✅

(d) Only the habitat of the organism

18. The study of the relationship of a single population to its environment is called:

(a) Synecology

(b) Autecology ✅

(c) Biogeography

(d) Physiology

19. The study of the relationship of different communities to their environment is called:

(a) Autecology

(b) Synecology ✅

(c) Ethology

(d) Paleontology

20. Which of the following shows the correct order of ecological integration?

(a) Community ⟶ Population ⟶ Individual

(b) Individual ⟶ Population ⟶ Community ✅

(c) Population ⟶ Individual ⟶ Community

(d) Community ⟶ Ecosystem ⟶ Individual

21. The biotic components of an ecosystem include:

(a) Air, water, and soil

(b) Plants, animals, and microorganisms ✅

(c) Temperature, energy, and gravity

(d) Sunlight, soil, and air

22. The abiotic components of an ecosystem include:

(a) All living organisms

(b) Decomposers and producers

(c) Air, water, and soil ✅

(d) Plants and animals

23. The hydrosphere refers to:

(a) Air layer of Earth

(b) Water layer of Earth ✅

(c) Soil layer of Earth

(d) Living layer of Earth

24. The lithosphere is related to:

(a) Air

(b) Water

(c) Earth or soil ✅

(d) Temperature

25. In an ecosystem, the main processes include:

(a) Growth and respiration

(b) Feeding, chemical circulation, and energy flow ✅

(c) Reproduction and migration

(d) Excretion and decomposition

26. The producers in an ecosystem are:

(a) Fungi and bacteria

(b) Green plants ✅

(c) Animals

(d) Decomposers

27. The organisms that obtain food directly or indirectly from producers are called:

(a) Producers

(b) Consumers ✅

(c) Decomposers

(d) Autotrophs

28. Decomposers are mainly:

(a) Fungi and bacteria ✅

(b) Insects and worms

(c) Birds and mammals

(d) Trees and shrubs

29. Decomposers release chemical ions such as:

(a) Oxygen, carbon dioxide, and water

(b) Nitrates, phosphates, and potassium ✅

(c) Hydrogen, nitrogen, and methane

(d) Carbon, sulfur, and chlorine

30. A food chain always begins with a:

(a) Primary consumer

(b) Secondary consumer

(c) Green plant (producer) ✅

(d) Decomposer

31. A food web is:

(a) A single line of energy flow

(b) A combination of many food chains ✅

(c) A chain with only two links

(d) A habitat for decomposers

32. The stability of an ecosystem is maintained by:

(a) Presence of decomposers

(b) Simplicity of food chains

(c) Variety of pathways in a food web ✅

(d) Absence of consumers

33. Succession in ecology refers to:

(a) The destruction of ecosystems

(b) Sequence of changes in community structure over time ✅

(c) Migration of animals

(d) Reproduction in plants

34. Primary succession occurs:

(a) On bare rock or sand where no life existed before ✅

(b) After a forest fire

(c) In agricultural fields

(d) In polluted water

35. Secondary succession differs from primary succession because:

(a) It starts on bare rocks

(b) It occurs more rapidly ✅

(c) It takes thousands of years

(d) It has no soil formation

36. The animal that hunts and eats other animals is called a:

(a) Prey

(b) Predator ✅

(c) Parasite

(d) Symbiont

37. The process of one animal feeding on another is called:

(a) Symbiosis

(b) Predation ✅

(c) Parasitism

(d) Grazing

38. In a predator-prey relationship, the population size of both species:

(a) Remains constant

(b) Is unrelated

(c) Affects each other cyclically ✅

(d) Is determined by environment only

39. Which of the following is a correct predator-prey example?

(a) Cow–grass

(b) Frog–mosquito ✅

(c) Tapeworm–man

(d) Bacteria–root nodule

40. The animal that provides food and protection to a parasite is called:

(a) Prey

(b) Host ✅

(c) Predator

(d) Consumer

41. The association between a host and a parasite is known as:

(a) Symbiosis

(b) Parasitism ✅

(c) Mutualism

(d) Commensalism

42. Parasites living outside the body of the host are called:

(a) Endoparasites

(b) Ectoparasites ✅

(c) Symbionts

(d) Mutualists

43. A tapeworm living inside the human intestine is an example of:

(a) Ectoparasite

(b) Endoparasite ✅

(c) Symbiosis

(d) Predator

44. Diseases caused by parasites are called:

(a) Infections

(b) Infestations ✅

(c) Mutations

(d) Contagions

45. The relationship in which both organisms benefit is called:

(a) Parasitism

(b) Commensalism

(c) Symbiosis ✅

(d) Predation

46. The association between fungi and plant roots is known as:

(a) Mycorrhiza ✅

(b) Lichen

(c) Nitrogen fixation

(d) Grazing

47. In mutualism, both organisms:

(a) Compete with each other

(b) Benefit from each other ✅

(c) Harm each other

(d) Remain unaffected

48. Lichen is a symbiotic association between:

(a) Fungus and algae ✅

(b) Bacteria and fungi

(c) Algae and moss

(d) Plant and bacteria

49. The relationship in which one organism benefits and the other is unaffected is:

(a) Mutualism

(b) Commensalism ✅

(c) Parasitism

(d) Predation

50. The process of animals feeding on grasses is called:

(a) Predation

(b) Grazing ✅

(c) Decomposition

(d) Mutualism

51. Overgrazing results in:

(a) Formation of forest

(b) Growth of more grass

(c) Barren land and soil erosion ✅

(d) Increase in soil fertility

52. The biogenic elements essential for life are also called:

(a) Macronutrients

(b) Micronutrients

(c) Nutrient elements ✅

(d) Chemical ions

53. Macronutrients are required in:

(a) Small quantity

(b) Large quantity ✅

(c) Trace amount

(d) Rare condition

54. The process that converts ammonia into nitrates is called:

(a) Assimilation

(b) Nitrification ✅

(c) Ammonification

(d) Denitrification

55. The process by which bacteria convert atmospheric nitrogen into organic compounds is called:

(a) Nitrogen fixation ✅

(b) Assimilation

(c) Ammonification

(d) Nitrification

56. About how much solar energy is trapped by producers in an ecosystem?

(a) 5%

(b) 10%

(c) 1% ✅

(d) 25%

🩸Q4: Exercise Short Questions

1. What are the biogeochemical cycles?

Answer:

👉 The biogeochemical cycles are the continuous movements of essential chemical elements (like carbon, nitrogen, oxygen, and water) between the living (biotic) and non-living (abiotic) parts of the ecosystem in a cyclic manner.

2. Sketch three main steps in nitrogen cycle.

Answer:

👉 The three main steps of the nitrogen cycle are:

- **Ammonification:** Decomposition of organic nitrogen compounds into ammonia.
- **Nitrification:** Conversion of ammonia into nitrites and nitrates by bacteria.
- **Assimilation:** Absorption of nitrates by plants to form amino acids and proteins.

3. Define grazing.

Answer:

👉 Grazing is the process in which herbivorous animals such as cows, goats, and sheep feed on grasses and other green plants. These animals are called grazers.

4. What percentage of sun energy reaches to plants?

Answer:

👉 Only about 1% of the total solar energy reaching the Earth is trapped by green plants during photosynthesis.

5. What is autecology?

Answer:

👉 Autecology is the study of the relationship of a single species or population with its environment.

6. Define synecology.

Answer:

👉 Synecology is the branch of ecology that studies the relationship of different communities (groups of populations) with their environment.

🩸Important Short Questions:

1. What is the meaning of the term ecology and who coined it?

Answer:

👉 The term ecology means the study of the relationship of organisms to their environment. It was first coined by the German zoologist Ernst Haeckel in 1866.

2. What does the word "oikos" mean in Greek?

Answer:

👉 The Greek word oikos means "house" or "family household", which refers to the environment or place where organisms live.

3. Define ecosystem.

Answer:

👉 An ecosystem is the basic unit of ecology in which living (biotic) and non-living (abiotic) components interact with each other to form a functional unit.

4. Name the two main components of an ecosystem.

Answer:

👉 The two main components of an ecosystem are:

1. Biotic components – all living things (plants, animals, microorganisms)

2. Abiotic components – all non-living things (air, water, soil, light, temperature)

5. What is meant by biotic and abiotic components?

Answer:

👉 Biotic components are living organisms like plants, animals, and microbes.

👉 Abiotic components are non-living factors like sunlight, temperature, air, water, and soil.

6. Define population in ecological terms?

Answer:

👉 A population is a group of interbreeding individuals of the same species living together in a particular area at the same time.

7. What is a community?

Answer:

👉 A community is made up of all the populations of different species living and interacting together within an ecosystem.

8. What is meant by a biome? Give one example.

Answer:

👉 A biome is a large geographical area having a distinct type of vegetation and climate.

👉 **Example:** Desert biome, forest biome, or grassland biome.

9. Define biosphere.

Answer:

👉 The biosphere is the thin layer of the Earth where all living organisms exist, interacting with air, water, and soil.

10. What is the difference between autecology and synecology?

Answer:

👉 **Autecology** is the study of a single species or population and its relationship to the environment.

👉 **Synecology** is the study of communities (groups of populations) and their relationship to the environment.

11. What are the two main components of an ecosystem?

Answer:

👉 The two main components of an ecosystem are:

1. Biotic components – all living organisms (plants, animals, microbes).

2. Abiotic components – all non-living factors (air, water, soil, temperature).

12. What is meant by biotic components?

Answer:

👉 Biotic components include all living organisms such as plants, animals, and microorganisms that live in the biosphere.

13. What is meant by abiotic components?

Answer:

👉 Abiotic components include all non-living elements of the environment like air, water, soil, temperature, light, and minerals.

14. What are the three ecological terms used for abiotic components?

Answer:

👉 The three ecological terms are:

(a) Atmosphere – air environment

(b) Hydrosphere – water environment

(c) Lithosphere – soil or earth environment

15. Name the three main components of an ecosystem based on feeding relationships.

Answer:

👉 The three main components are:

1. Producers

2. Consumers

3. Decomposers

16. What are producers? Give one example.

Answer:

👉 Producers are green plants that make their own food by photosynthesis.

👉 **Example:** Grass, algae, or any green plant.

17. What are consumers?

Answer:

👉 Consumers are organisms (mostly animals) that depend directly or indirectly on producers for their food.

18. What are decomposers? Give examples.

Answer:

👉 Decomposers are organisms that break down dead plants and animals into simpler substances.

👉 **Examples:** Bacteria and fungi.

19. What is a food chain?

Answer:

👉 A food chain is the sequence of organisms in which one organism eats another and transfers energy in the ecosystem.

👉 **Example:** Grass → Caterpillar → Bird → Eagle

20. What is a food web?

Answer:

👉 A food web is a network of interconnected food chains showing all possible feeding relationships in an ecosystem.

21. What is the importance of a food web in an ecosystem?

Answer:

👉 A food web helps to maintain the stability and balance of the ecosystem by providing alternate food sources for organisms.

22. Define trophic level.

Answer:

👉 A trophic level is the feeding level or position of an organism in a food chain.

👉 **Example:** Producers = 1st trophic level, Primary consumers = 2nd trophic level.

23. What is ecological succession?

Answer:

👉 Succession is the gradual and predictable change in the community structure of an ecosystem over time, leading to a stable climax community.

24. What are the two major types of succession?

Answer:

👉 **The two major types of succession are:**

1. Primary succession – starts on bare rocks or new surfaces.

2. Secondary succession – starts after the destruction of a previous community.

25. What is a climax community?

Answer:

👉 A climax community is the final stable stage of succession where the ecosystem becomes balanced and self-sustaining, usually forming a forest.

26. What is predation?

Answer:

👉 Predation is the process in which one animal (predator) hunts, kills, and eats another animal (prey) for food.

27. What is the relationship between predator and prey populations?

Answer:

👉 The sizes of predator and prey populations are interdependent — when prey increases, predator numbers also rise; when prey decreases, predator numbers fall.

28. Give two examples of predator and prey relationships.

Answer:

👉 **Examples:**

1. Cat and mouse

2. Fox and rabbit

29. Define parasitism.

Answer:

👉 Parasitism is an association between a host and a parasite, in which the parasite gets food and shelter from the host and may or may not harm it.

30. What are ectoparasites and endoparasites? Give examples.

Answer:

👉 **Ectoparasites**: Live on the surface of the host (e.g. fungi causing dandruff).

👉 **Endoparasites**: Live inside the host (e.g. tapeworm in human intestine).

31. Define symbiosis.

Answer:

👉 Symbiosis is a close association between two organisms in which both partners benefit from each other.

32. Give an example of symbiosis in plants.

Answer:

👉 **Example:** Leguminous plants (pea/bean) and nitrogen-fixing bacteria in root nodules.

33. What is Mycorrhiza?

Answer:

👉 Mycorrhiza is a symbiotic association between the roots of plants (like pine, beech, heather) and certain fungi that help absorb minerals from soil.

34. What is mutualism? Give one example.

Answer:

👉 Mutualism is a relationship in which both organisms benefit equally.

👉 **Example:** Insects and flowering plants — insects get nectar, plants get pollinated.

35. What are lichens?

Answer:

👉 Lichens are dual organisms formed by a symbiotic association of an alga and a fungus, usually found on bare rocks or tree trunks.

36. Define commensalism.

Answer:

👉 Commensalism is a type of relationship in which one organism benefits while the other is neither harmed nor benefited.

37. Give an example of commensalism.

Answer:

👉 **Example:** Remora fish and shark — remora eats leftover food while the shark is unaffected.

38. What is grazing?

Answer:

👉 Grazing is a mode of feeding in which animals like cows, goats, and rabbits feed on grasses and herbs.

39. What is overgrazing and what are its effects?

Answer:

👉 Overgrazing occurs when too many animals feed on pastureland, destroying grasses and compacting soil — leading to barren land and soil erosion.

40. What is moderate grazing and why is it beneficial?

Answer:

👉 Moderate grazing helps maintain the grassland ecosystem by removing competitors and encouraging healthy grass regrowth.

Q5: Extensive Questions

🌟 **Q1: Define environment. What must environment supply for insects, green plants, birds, animals and people?**

❖ **Definition of Environment:**

👉 The environment is the sum of all external conditions and influences that affect the life and development of living organisms.

It includes both living (biotic) and non-living (abiotic) components surrounding an organism.

In simple words:

> The surroundings in which an organism lives, grows, and interacts with other organisms and physical factors are called its environment.

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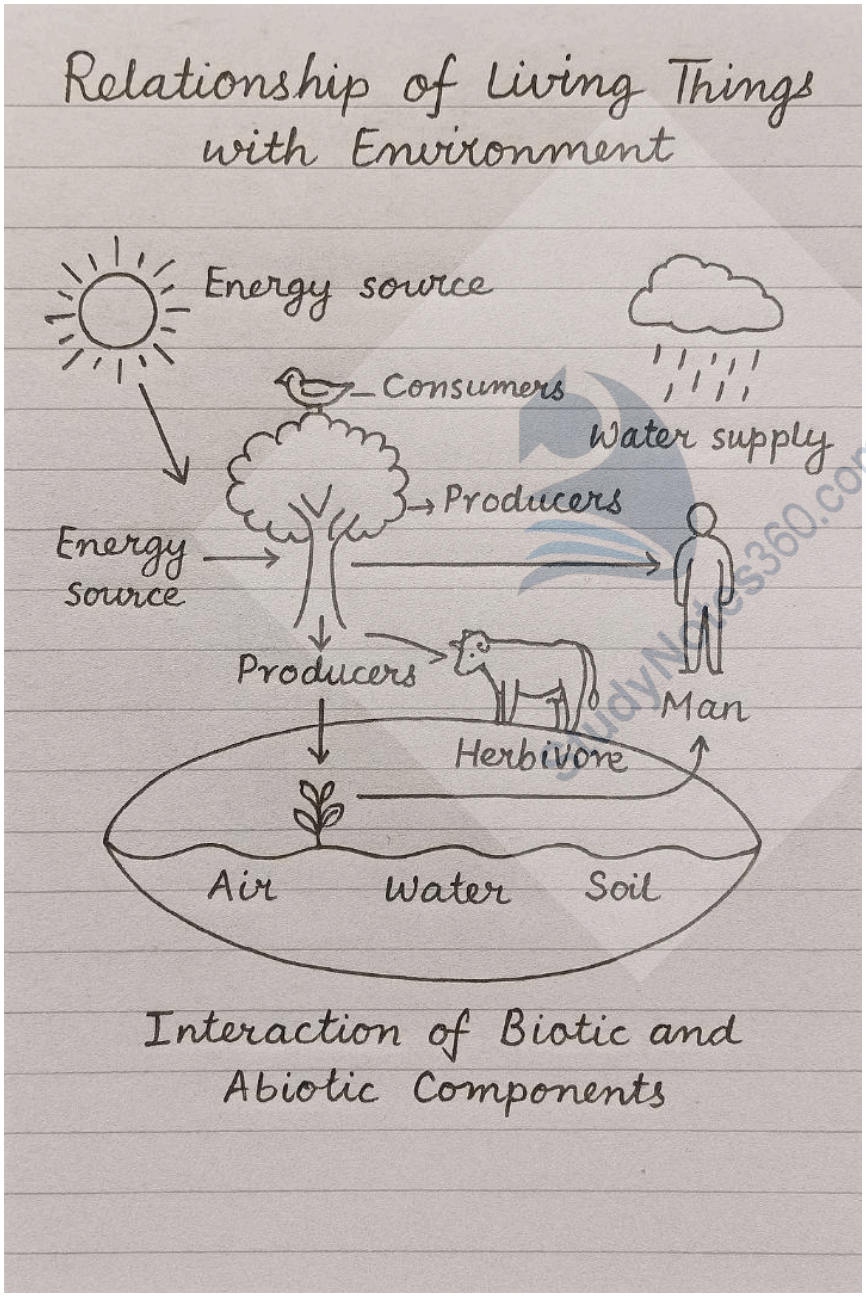

🌎 Main Components of Environment:

The environment consists of two major components:

1. Abiotic (Non-living) Components:

- These include physical and chemical factors like air, water, light, soil, temperature, humidity, minerals, etc.
- They determine the type of organisms that can survive in a region.

2. Biotic (Living) Components:

- These include all living things such as plants, animals, microorganisms, and humans that interact with each other and with abiotic factors.

🌱 What Environment Must Supply to Living Organisms

🐛 (1) For Insects:

- The environment provides air, water, and suitable temperature for survival.
- It also provides food sources such as plant sap, nectar, or other smaller insects.
- Moisture and shelter (like under leaves or in soil) are necessary for egg laying and protection.

🌿 (2) For Green Plants:

- Plants need sunlight for photosynthesis.
- Carbon dioxide from the air and water from the soil are essential for food making.
- Minerals and nutrients from the soil support growth and development.
- The environment also provides space and air for respiration.

🐦 (3) For Birds:

- The environment provides trees and shrubs for nesting and protection.
- Air and oxygen for breathing.
- Insects, fruits, grains, and small animals as food.
- Open sky and temperature balance for flight and migration.

🐄 (4) For Animals:

- The environment provides food, water, and air for respiration.
- Shelter for protection from predators and climate.
- Space for movement, reproduction, and territory establishment.

👨‍👩‍👧‍👦 (5) For People (Humans):

- Environment supplies oxygen, food, water, and shelter for survival.
- Raw materials like wood, metals, and fuel are taken from the environment.
- It provides climatic balance and natural beauty essential for healthy living.

🔁 Relationship Between Organisms and Environment

- All organisms depend upon each other and their environment for survival.
- A change in environment directly affects the balance of the ecosystem.
- Plants purify the air, animals help in pollination and seed dispersal, and decomposers recycle nutrients — showing a complete interdependence.

✦ **Summary:**

👉 Environment is a combination of all living and non-living factors that influence the life of organisms.

👉 It must provide all necessary conditions like air, water, food, light, temperature, and shelter for insects, plants, birds, animals, and humans.

👉 Life is only possible when there is a balance between organisms and their environment.

🌟 Q2: What factors in the environment can affect all living things? Are they important to survive in a biome?

❖ Introduction:

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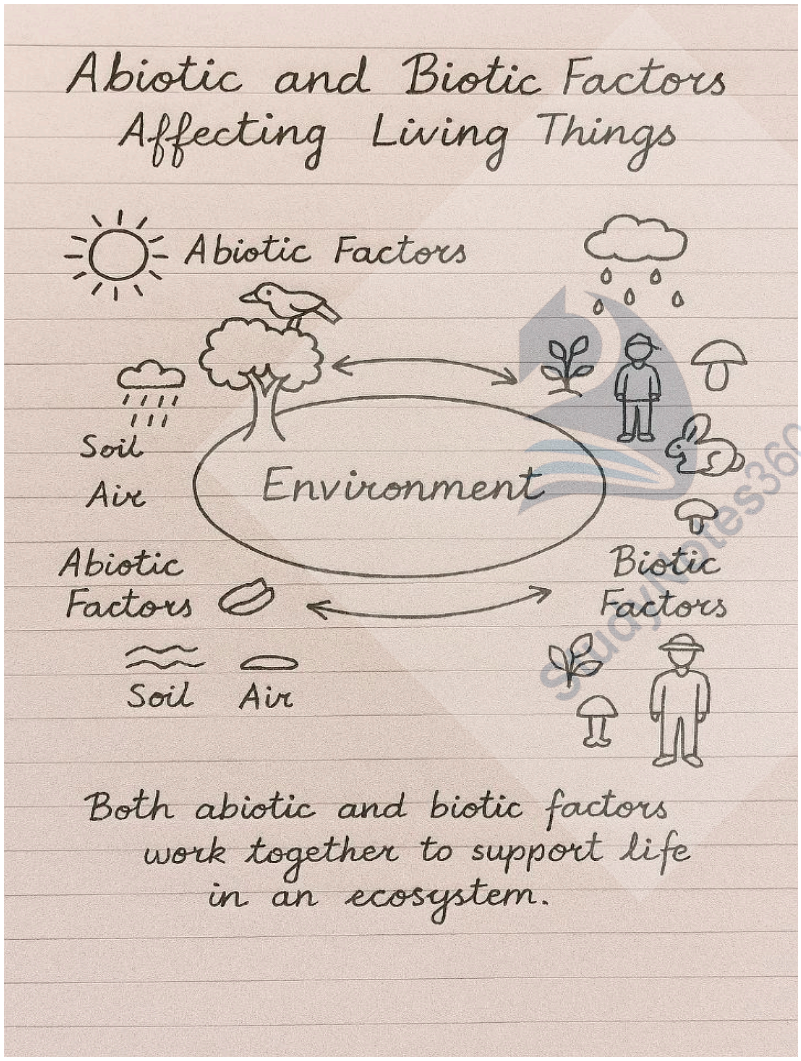

- All living organisms — plants, animals, and microorganisms — depend on their environment for survival.

- The environment provides them with food, water, air, and shelter.
- Various factors in the environment directly affect their growth, distribution, and way of life.
- These factors are broadly divided into abiotic (non-living) and biotic (living) components.

🌤️ Abiotic Factors (Non-living Components)

- Abiotic factors are the physical and chemical elements of the environment that influence living organisms.

1. Light:

- Light is the main source of energy for all life on Earth. Plants use sunlight in photosynthesis to make food, and animals depend on these plants directly or indirectly. Light also affects animal activities such as reproduction, migration, and sleep.

2. Temperature:

- Temperature controls the metabolic rate of organisms. Some organisms can survive only in warm climates, while others live in cold regions. For example, polar bears survive in freezing temperatures, whereas camels live in hot deserts.

3. Water:

- Water is essential for all living organisms. It is required for photosynthesis, respiration, digestion, and transportation of nutrients. The availability of water determines whether an area will be a desert, grassland, or forest.

4. Air:

- Air provides oxygen for respiration and carbon dioxide for photosynthesis. Wind helps in pollination and seed dispersal, which are necessary for the continuation of plant species.

5. Soil:

- Soil gives support and nutrients to plants. Its composition, texture, and mineral content decide what type of vegetation will grow in an area. Good soil means a productive ecosystem.

6. Humidity and Rainfall:

- Moisture in the air and the amount of rainfall influence plant growth and animal life. Forests develop in areas with heavy rainfall, while deserts form in areas with little rain.

7. Minerals and Salts:

- Mineral elements like calcium, phosphorus, and potassium are essential for growth and metabolism. Their presence or absence greatly affects living organisms.

🌿 Biotic Factors (Living Components):

Biotic factors include all living organisms that interact with each other in an ecosystem.

1. Producers:

- Green plants are producers because they make their own food using sunlight and supply energy to other living beings.

2. Consumers:

- Animals are consumers because they depend on plants or other animals for food. They play a vital role in maintaining the balance of nature.

3. Decomposers:

- Bacteria and fungi are decomposers. They break down dead plants and animals, releasing nutrients back into the soil and keeping the ecosystem clean.

4. Human Beings:

- Humans are an important part of the biotic world. Their activities such as deforestation, pollution, and urbanization can positively or negatively affect other living organisms.

🌳 Importance of Environmental Factors in Biomes:

- A biome is a large natural region with a specific climate, plants, and animals.
- Every biome — such as forest, desert, tundra, or ocean — is formed and maintained by environmental factors.
- **For example,** deserts are dry and hot, so only organisms like camels and cactus can survive there.
- Forests have sufficient rain and moderate temperature, so tall trees and a variety of animals live there.
- In cold biomes like the tundra, only animals with thick fur and fat layers can survive.
- If any major factor like temperature or water changes, the entire biome may be destroyed or transformed into another type.

✦ Summary:

- All living organisms are closely linked with their environment.
- Both abiotic and biotic factors are equally important for their survival.

- They decide where organisms can live, how they grow, and how they interact with each other.
- Every biome on Earth depends on these factors for its balance and stability.
- A change in any of these conditions can disturb the entire ecosystem.

🌟 Q3. What can you conclude about all the physical and biological factors in an environment?

❖ Introduction:

- Every living organism exists within an environment that provides all the conditions necessary for life.
- This environment is made up of two main parts: physical (abiotic) and biological (biotic) factors.

Both types are interconnected and together they create a balanced ecosystem in which life can exist, grow, and reproduce.

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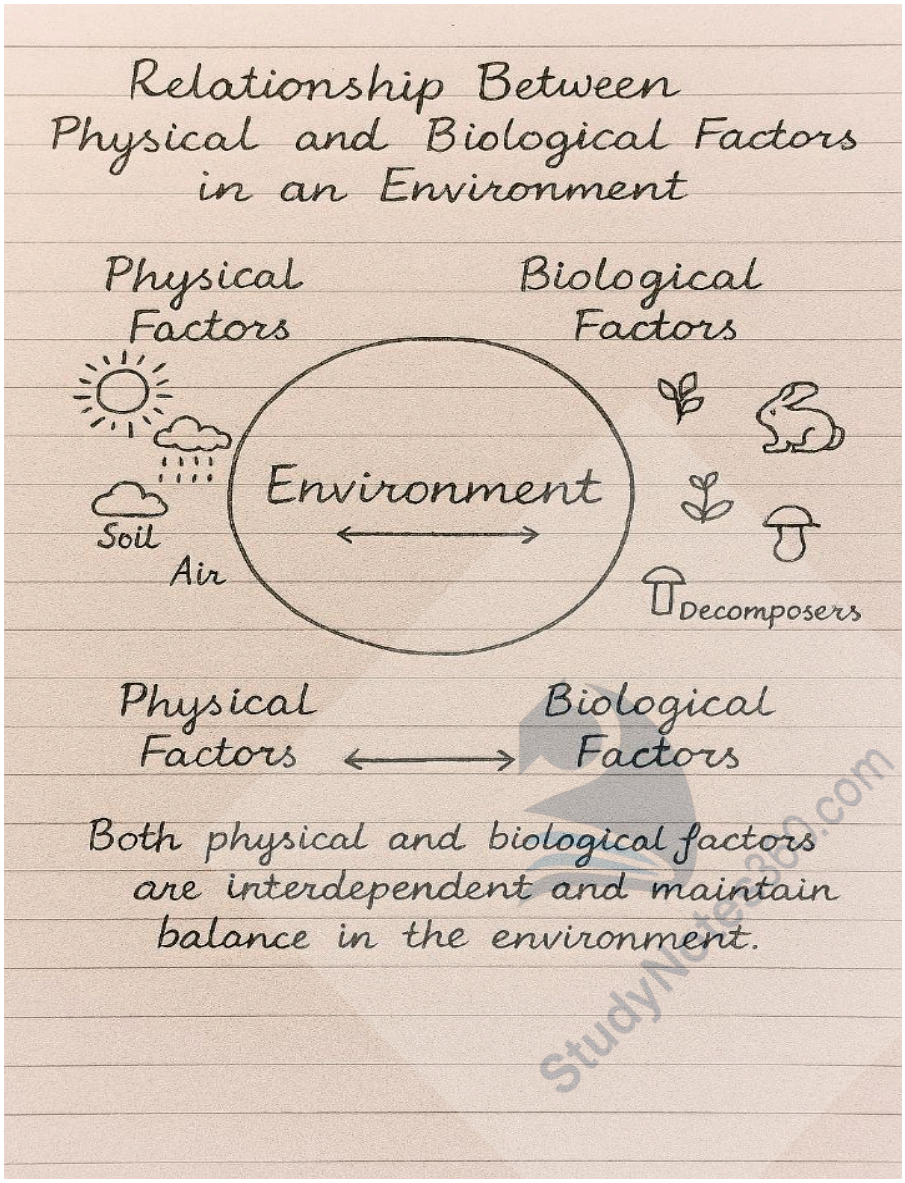

🌤️ Physical Factors (Abiotic Components)

- Physical factors are the non-living parts of the environment. They form the basic structure and conditions under which living things survive.

These include light, temperature, water, soil, air, and minerals.

1. Light:

- It is the main source of energy for all life on Earth. Plants use sunlight to make food through photosynthesis. Animals depend on plants directly or indirectly, so light is essential for all life.

2. Temperature:

- The degree of heat or cold in an area affects the metabolism, behavior, and distribution of organisms. Different species can live only within specific temperature ranges.

3. Water:

- It is vital for every life process such as photosynthesis, respiration, and transport of materials. The amount of water available determines the type of plants and animals living in an area.

4. Air:

- Air contains gases like oxygen and carbon dioxide, which are essential for respiration and photosynthesis. Wind also affects pollination and the spreading of seeds.

5. Soil:

- It supports plant life and provides essential minerals and nutrients. Soil quality and type determine which plants can grow in a particular region.

6. Minerals and Salts:

- These chemical substances are required by both plants and animals for growth and body functions.

🌿 Biological Factors (Biotic Components)

- Biological factors are the living parts of the environment.
- They include all organisms that interact with each other, forming food chains and energy flow systems.

1. Producers (Plants):

- They are autotrophs that prepare food using sunlight and form the base of every food chain.

2. Consumers (Animals):

- They depend on plants or other animals for food. They include herbivores, carnivores, and omnivores.

3. Decomposers (Bacteria and Fungi):

- They break down dead plants and animals, returning nutrients to the soil for reuse.
- This process keeps the environment clean and maintains the balance of nature.

4. Human Beings:

- Humans also play a major role in the biological system. They can help protect or harm the environment through their activities.

🌱 Relationship Between Physical and Biological Factors:

- Both types of factors are deeply connected.
- Physical factors like sunlight and soil provide the basic resources for plants to grow.
- Biological factors like animals and decomposers ensure the recycling of nutrients.
- If one factor changes, it affects all others. For example, less rainfall affects plants, which in turn affects herbivores and carnivores.

Thus, all factors work together to maintain the balance of the ecosystem.

✦ Summary:

From the study of all physical and biological factors, we can conclude that:

✅ Both are essential and interdependent parts of the environment.

✅ Physical factors provide the conditions necessary for life, while biological factors maintain energy flow and nutrient cycling.

✅ Any disturbance in one part affects the entire system.

✅ The harmony between abiotic and biotic factors ensures the stability, survival, and sustainability of life on Earth.

🌟 **Q4: What is biosphere? What must the biosphere provide for living things? Why is a biosphere absent on the moon?**

❖ **Introduction:**

- The Earth is a unique planet because it supports life.
- All living organisms — from the smallest microorganisms to the largest animals — live in a thin, life-supporting layer known as the biosphere.
- This layer includes parts of the land, water, and air where life exists. The biosphere is essential for maintaining the balance of life and the environment.

❖ Definition of Biosphere

👉 Biosphere is defined as:

> “The thin layer of the Earth where all living organisms exist and interact with one another and with their physical environment.”

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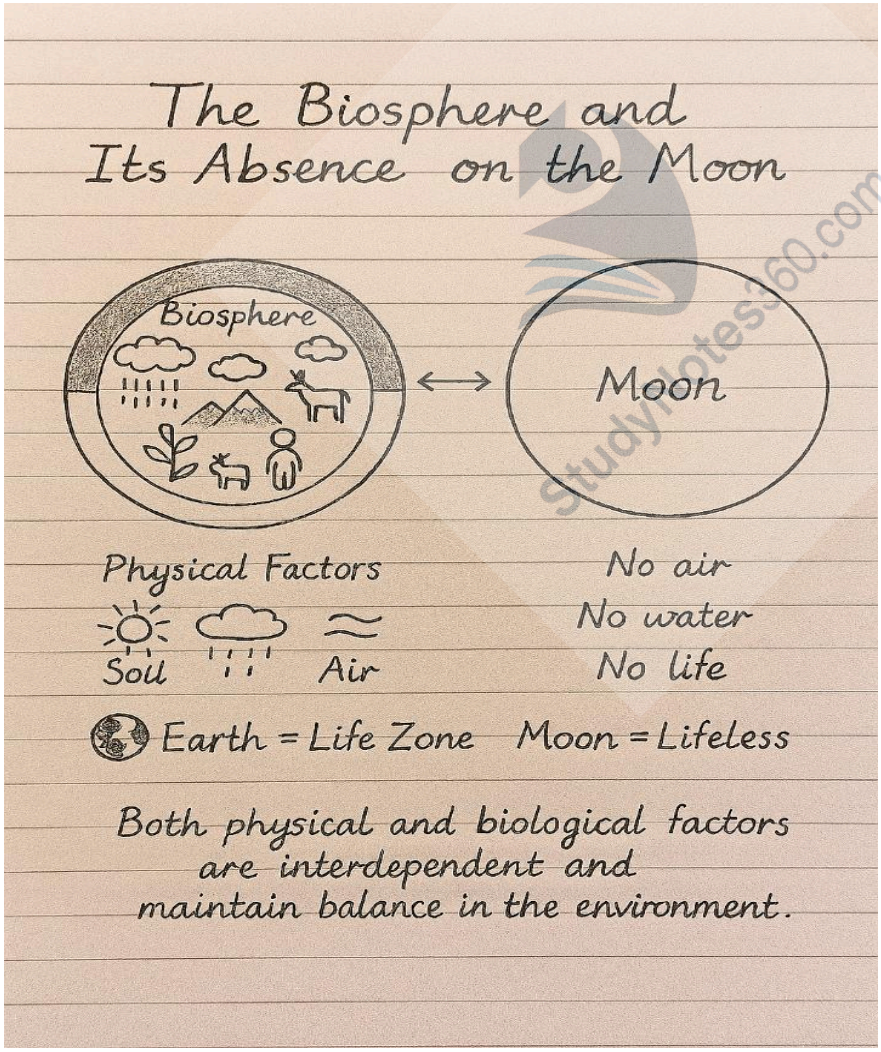

✦ It includes three main parts of the Earth:

1. Atmosphere (the layer of air surrounding the Earth)

2. Lithosphere (the solid part — soil and rocks)

3. Hydrosphere (the water bodies — oceans, rivers, lakes)

Life exists only within a small range — roughly 8–10 km above and below the Earth's surface.

💧 What the Biosphere Must Provide for Living Things:

For living organisms to survive, the biosphere must supply several essential conditions and materials:

1. Air (Oxygen and Carbon Dioxide):

- Animals need oxygen for respiration, while plants need carbon dioxide for photosynthesis.

2. Water:

- All life activities — such as digestion, growth, and transport of nutrients — require water. Water is also the main habitat for aquatic organisms.

3. Suitable Temperature:

- The Earth's biosphere provides moderate temperatures suitable for most living organisms to carry out their metabolic processes.

4. Food and Nutrients:

- The biosphere contains producers, consumers, and decomposers that form food chains and ensure a continuous supply of nutrients.

5. Light (Energy Source):

- Sunlight is the primary energy source for photosynthesis, which supports almost all life in the biosphere.

6. Protection:

- The atmosphere shields living things from harmful solar radiation and maintains suitable pressure for survival.

🌑 Why a Biosphere Is Absent on the Moon:

- The Moon does not support life, and therefore it has no biosphere.

- This is because it lacks the essential factors needed for life to exist.

Main Reasons:

1. No Atmosphere:

- The Moon has no air; hence, no oxygen for breathing and no carbon dioxide for photosynthesis.

2. No Water:

- Liquid water — essential for all life processes — is absent on the Moon.

3. Extreme Temperatures:

- The Moon experiences extreme temperature changes, from very hot during the day to freezing cold at night — conditions unsuitable for life.

4. No Protection from Radiation:

- Without an atmosphere, the Moon's surface is exposed to harmful cosmic and ultraviolet radiation.

5. Absence of Organic Matter:

- There is no soil, plants, or microorganisms to produce or recycle nutrients.

✦ **Summary:**

✅ The biosphere is the life-supporting zone of the Earth where living organisms interact with air, water, and land.

✅ It provides all essential elements — air, water, sunlight, food, and protection — for life to exist and flourish.

✅ The Moon lacks these basic requirements; therefore, it cannot support a biosphere or any form of life.

🌟 **Q5: Define Succession. Discuss Succession on Land.**

❖ **Definition:**

Succession is a natural and gradual process through which one community of organisms is replaced by another until a stable climax community is formed. It occurs due to changes in the physical environment and living organisms over time.

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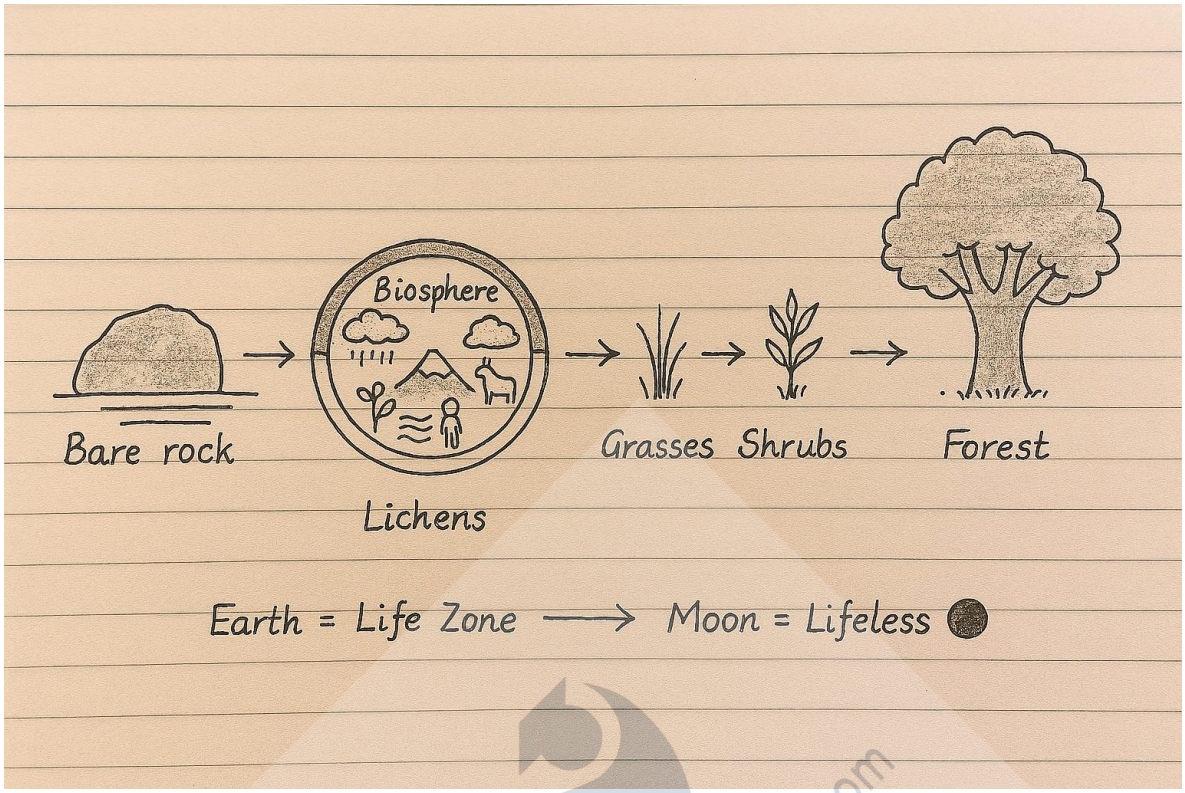

✦ **There are two main types:**

- **Primary Succession:** Begins on bare land or rocks where life never existed.
- **Secondary Succession:** Occurs where life existed before but was destroyed by natural disturbances like fire or flood.

Succession on Land (Xerosere):

- Succession that occurs on dry, barren land is called Xerosere.
- It starts with lichens and ends with the formation of a forest.

Stages of Xerosere:

1. Crustose Lichen Stage:

- Lichens grow on bare rocks.
- They break rocks into small particles to form soil.

2. Moss Stage:

- Mosses grow in the thin soil formed by lichens.
- Soil becomes more fertile.

3. Herb Stage:

- Grasses and small herbs appear.
- They add more organic matter to the soil.

4. Shrub Stage:

- Shrubs and bushes grow as soil deepens.
- Shade and moisture increase.

5. Climax Stage:

- Large trees grow and form a forest.
- The ecosystem becomes stable and self-sustaining.

Importance of Succession:

- Helps in soil formation.
- Increases biodiversity.
- Creates stable ecosystems.
- Restores balance in nature.

✦ **Summary:**

Succession on land (Xerosere) begins on dry, lifeless areas and slowly leads to the growth of a mature forest community. It shows how life gradually changes and adapts to make the environment suitable for future organisms.

🩸Important Long Questions:

🌟 **Q1: Define ecosystem. Describe its main components with examples.**

❖ **Definition of Ecosystem:**

- An ecosystem is a natural unit in which living organisms interact with each other and with their physical environment.
- It is the basic unit of ecology where both biotic (living) and abiotic (non-living) components function together as a system.

👉 The word “eco” means environment, and “system” means a collection of related parts that work as a unit.

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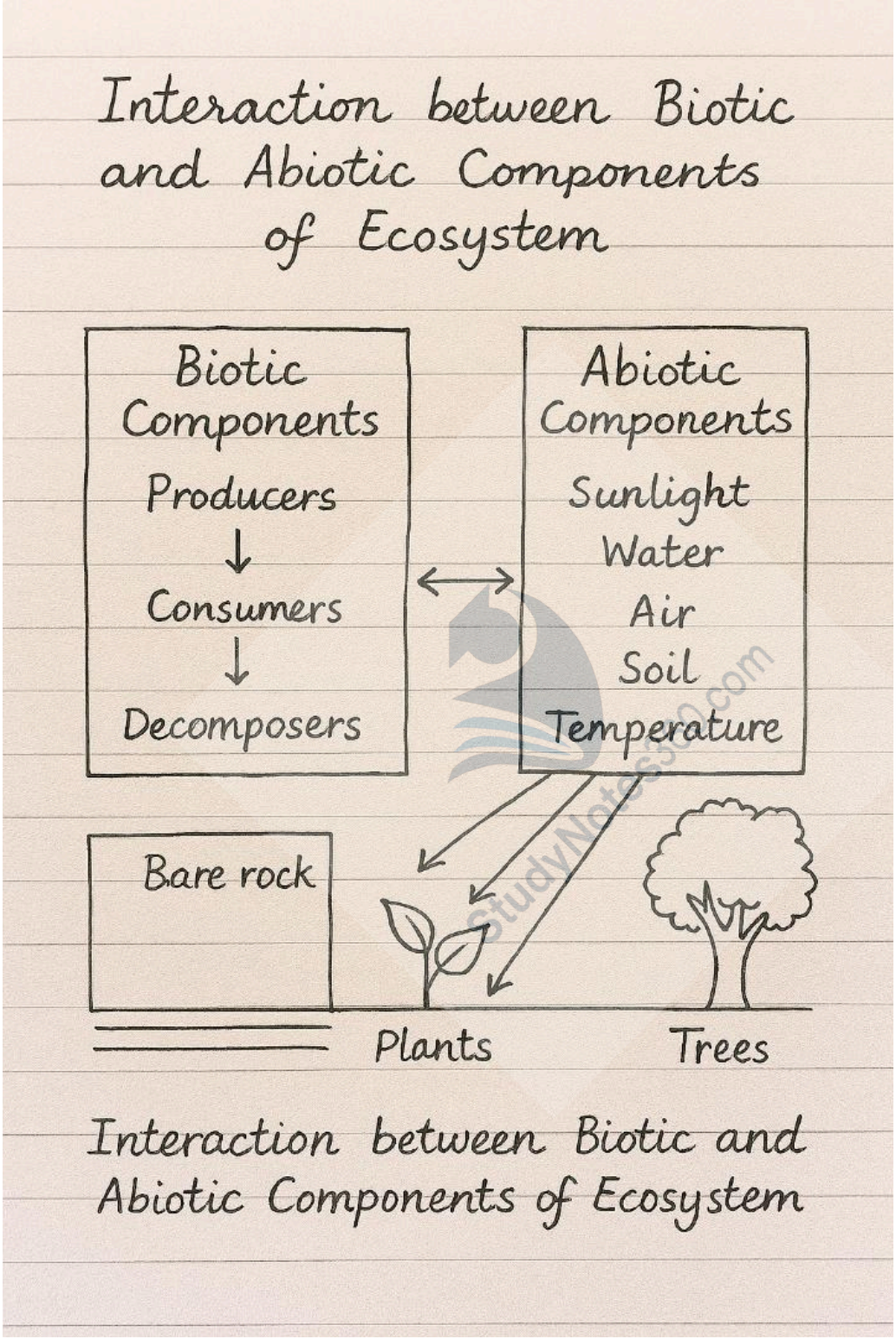

🌱 Main Components of Ecosystem:

An ecosystem has two main components:

1. Biotic Components (Living)

2. Abiotic Components (Non-living)

🌿 1. Biotic Components

- These include all living organisms present in the ecosystem.

They are classified into three major groups:

(a) Producers (Autotrophs)

- These are green plants and algae which prepare their own food through photosynthesis.
- They convert solar energy into chemical energy.

🌾 **Example:** Grass, trees, phytoplankton, algae.

(b) Consumers (Heterotrophs)

- These depend on producers or other consumers for food.
- They include animals and human beings.

Consumers are further divided into:

- **Primary consumers:** Herbivores (e.g., rabbit, cow, goat)
- **Secondary consumers:** Carnivores (e.g., snake, frog)
- **Tertiary consumers:** Top predators (e.g., lion, eagle, tiger)

(c) Decomposers (Saprotrophs)

- These are microorganisms such as bacteria and fungi.
- They decompose dead plants and animals into simple inorganic substances, returning nutrients to the soil.

🌾 **Example:** Fungi growing on rotten wood, soil bacteria.

🌎 2. Abiotic Components

- These are non-living physical and chemical factors of the environment that affect living organisms.
- They provide the conditions necessary for life and growth.

Some major abiotic factors include:

- Sunlight – Provides energy for photosynthesis.
- Temperature – Affects growth and metabolism.
- Water – Essential for all living activities.
- Air (Oxygen and Carbon dioxide) – Needed for respiration and photosynthesis.

- Soil – Provides minerals and support for plant growth.
- Climate – Influences distribution of organisms.

🧠 Examples of Ecosystems:

1. Pond Ecosystem: Includes fish, frogs, algae, aquatic plants, and microorganisms.

2. Forest Ecosystem: Includes trees, birds, insects, mammals, decomposers, air, and sunlight.

3. Desert Ecosystem: Includes cactus, snakes, lizards, sand, and dry air.

✦ **Summary:**

- An ecosystem is a balanced unit of nature where biotic and abiotic components interact and depend on one another.
- Producers capture solar energy, consumers utilize it, and decomposers recycle nutrients — maintaining the flow of energy and matter essential for life on Earth.

🌟 Q2: Explain the Importance of Ecosystems in Maintaining Balance in Nature.

❖ **Introduction:**

- An ecosystem is a natural system in which living (biotic) and non-living (abiotic) components interact with each other.
- These interactions help in maintaining the natural balance of life on Earth by regulating the flow of energy and recycling of nutrients.
- Without ecosystems, life would not be able to sustain itself.

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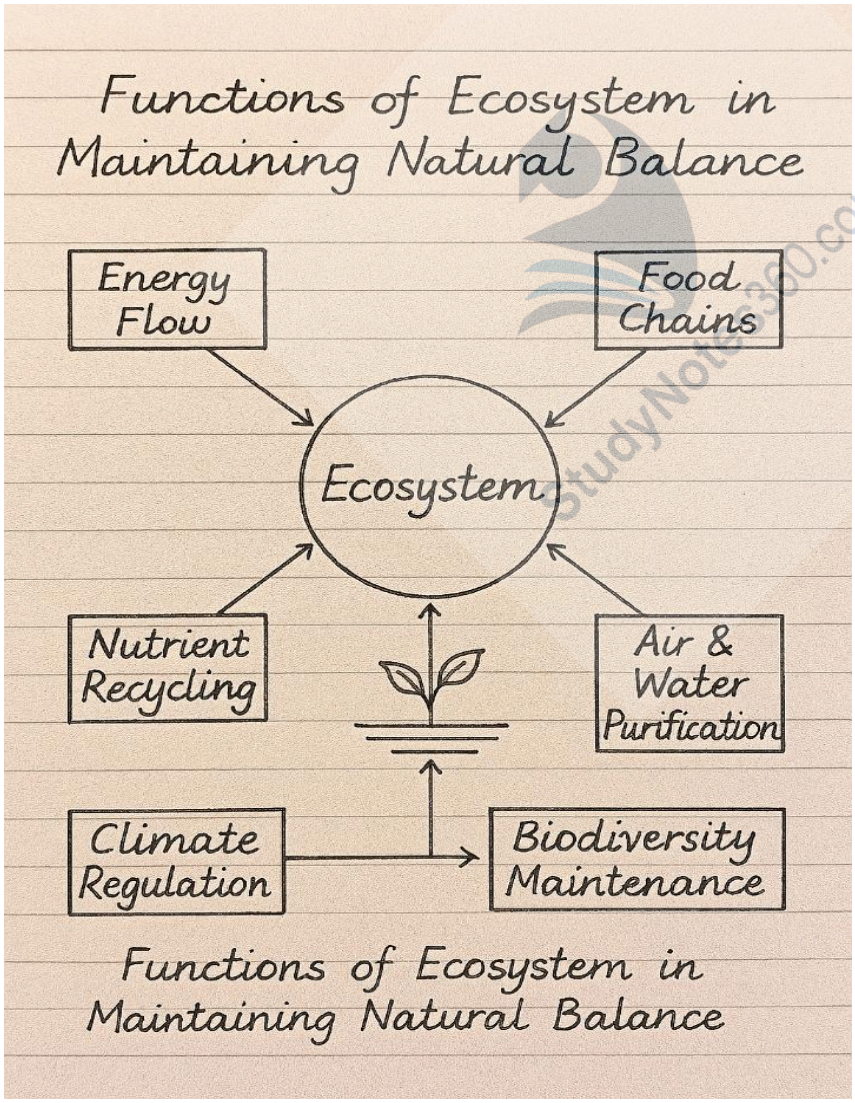

1. Energy Flow in Nature:

- The sun is the main source of energy for all ecosystems.
- Green plants (producers) capture solar energy and convert it into food through photosynthesis.
- This energy passes to consumers (animals) and finally to decomposers, maintaining the energy cycle.

👉 Thus, ecosystems ensure a continuous flow of energy needed by all living things.

2. Recycling of Nutrients:

- Dead plants and animals are broken down by decomposers such as fungi and bacteria.
- These decomposers release nutrients like nitrogen, phosphorus, and potassium back into the soil.
- Plants reuse these nutrients for growth, completing the biogeochemical cycles (like nitrogen and carbon cycles).

👉 This recycling maintains soil fertility and supports new life.

3. Food Chains and Food Webs:

In an ecosystem, organisms depend on one another for food, forming food chains and food webs.

Example: Grass ⟶ Grasshopper ⟶ Frog ⟶ Snake ⟶ Eagle

- These food links keep the population of species under control.

👉 Ecosystems thus maintain ecological balance and prevent overpopulation of any single species.

💧 4. Purification of Air and Water:

- Plants absorb carbon dioxide and release oxygen through photosynthesis, keeping the air clean.
- Wetland and aquatic ecosystems help in filtering and purifying water naturally.

👉 This maintains healthy air and clean water, essential for life.

🌍 5. Climate Regulation:

- Forest ecosystems help in reducing global warming by absorbing carbon dioxide.
- Vegetation also helps in maintaining humidity, rainfall, and temperature.

👉 Ecosystems thus contribute to climate stability across the planet.

🌸 6. Habitat and Biodiversity:

- Ecosystems provide shelter, food, and breeding grounds for all living organisms.
- They support biodiversity, ensuring the survival of various species.

👉 Balanced ecosystems prevent species extinction and maintain biological diversity.

🔄 7. Natural Control and Self-Regulation:

- Every ecosystem has natural checks and balances.
- Predation, competition, and decomposition control population sizes.

👉 This self-regulating mechanism keeps nature in balance without human interference.

✦ Summary:

- Ecosystems are essential for energy flow, nutrient recycling, purification, and biodiversity.
- They keep air, water, and soil suitable for life.
- Without balanced ecosystems, the Earth would face pollution, climate imbalance, and loss of life.

🌿 Hence, ecosystems maintain the harmony and balance of nature, making the planet a suitable place for all living organisms.

🌟 **Q3: Define and explain the components of an ecosystem. (Discuss biotic and abiotic components with examples.)**

❖ **Definition of Ecosystem:**

An ecosystem is a natural system formed by the interaction of living (biotic) and non-living (abiotic) components in a particular environment.

➡️ These components depend on one another through the flow of energy and cycling of nutrients.

Example: Forest, pond, desert, or ocean ecosystem.

🌱 Main Components of Ecosystem

Ecosystem has two main parts:

1. Biotic Components (Living)

2. Abiotic Components (Non-living)

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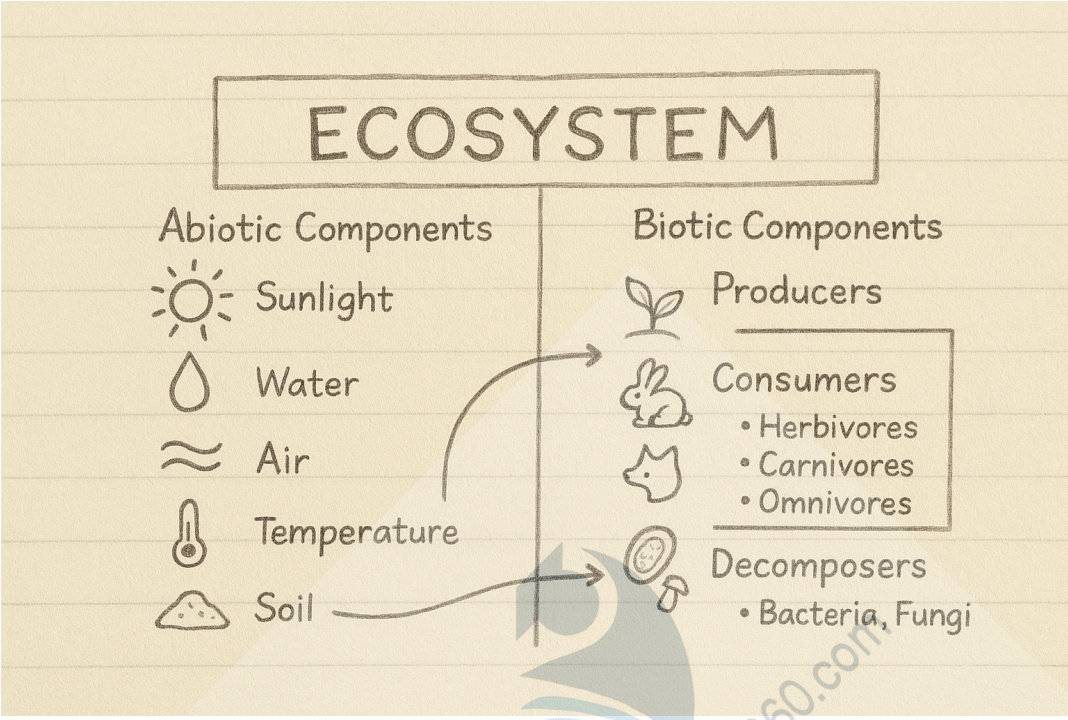

🌾 1. Biotic Components (Living Components):

- These include all living organisms in an ecosystem such as plants, animals, and microorganisms.

They are divided into three main groups:

a) Producers (Autotrophs):

- These are green plants that prepare their own food through photosynthesis.
- They convert solar energy into chemical energy (food).

Examples: Grass, trees, algae, phytoplankton.

b) Consumers (Heterotrophs):

- These organisms depend on producers or other animals for food.

Types:

- **Primary consumers:** Eat plants (e.g., rabbit, deer).
- **Secondary consumers:** Eat primary consumers (e.g., frog, fox).
- **Tertiary consumers:** Eat secondary consumers (e.g., eagle, lion).

c) Decomposers (Saprotrophs):

- These are bacteria and fungi that feed on dead and decaying organisms.
- They help recycle nutrients into the environment.

Examples: Fungi, bacteria.

🌍 2. Abiotic Components (Non-Living Components):

- These are non-living physical and chemical elements of an ecosystem.

- They influence the survival and activities of organisms.

Major Abiotic Factors:

- **Air (Atmosphere):** Provides gases like oxygen and carbon dioxide.
- **Water (Hydrosphere):** Required for all life activities.
- **Soil (Lithosphere):** Source of minerals and place for plant growth.
- **Sunlight**: Main source of energy for photosynthesis.
- **Temperature**: Controls metabolic activities.
- **Topography & Gravity:** Affect distribution and movement of organisms.

⚡ Interaction Between Biotic and Abiotic Components:

Both types of components are interconnected:

- Plants use sunlight, water, and CO_2 to make food.
- Animals eat plants and other animals.
- Decomposers return minerals to the soil.

➡️ This continuous interaction maintains balance in the ecosystem.

✦ Summary:

An ecosystem is the relationship between living and non-living components of nature.

- Biotic components (plants, animals, decomposers) depend on
- Abiotic components (air, water, soil, light, temperature) for survival.

Together, they maintain natural balance, recycle nutrients, and ensure the continuity of life on Earth.

🌟 Q4: Define and explain the terms "Food Chain" and "Food Web". (Give suitable examples and show their ecological importance.)

❖ Definition of Food Chain:

A food chain is a linear sequence of organisms through which energy and nutrients are passed as one organism eats another.

In simple words, it shows "who eats whom" in an ecosystem.

➡️ Example:

🌿 Grass ⟶ Grasshopper ⟶ Frog ⟶ Snake ⟶ Eagle

Here, each organism depends on the previous one for food, and energy flows in one direction only — from producers to top consumers.

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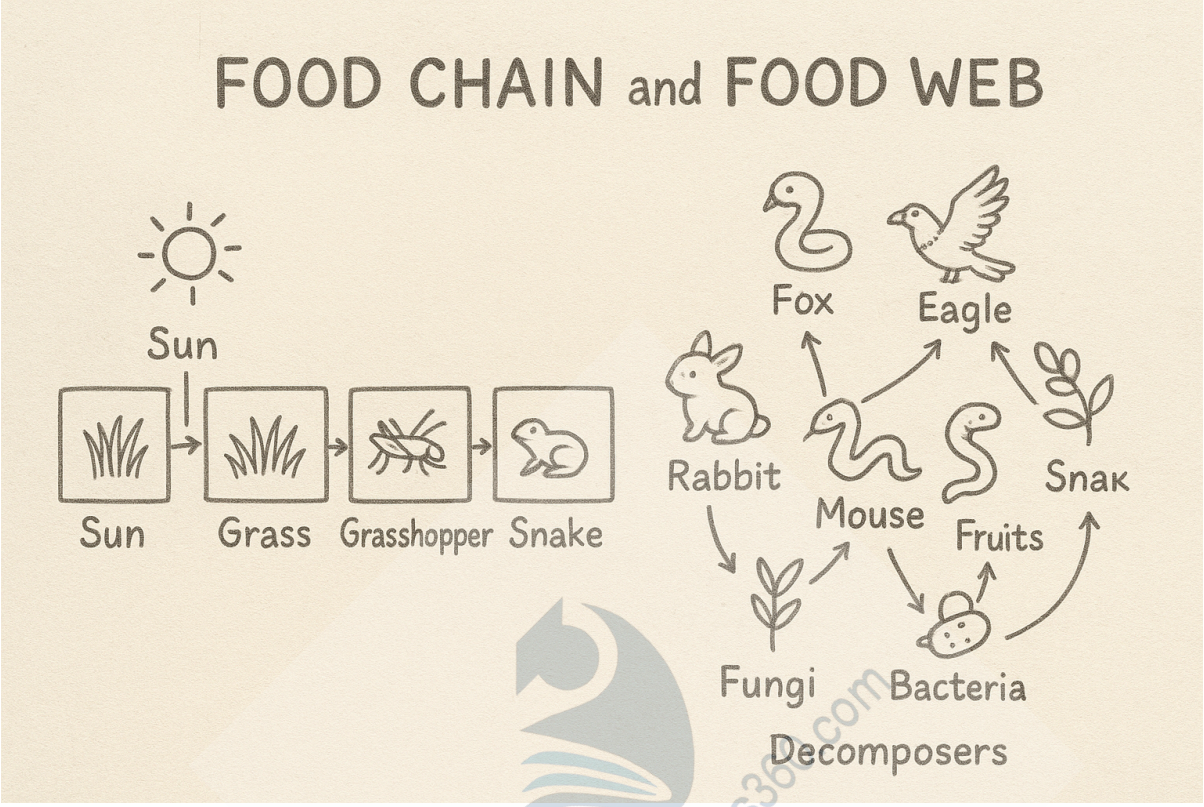


🌱 Explanation of Food Chain:

1. Producers:

- These are green plants that prepare food through photosynthesis.

Example: Grass, algae.

2. Primary Consumers:

- Herbivores that eat producers.

Example: Grasshopper, rabbit, deer.

3. Secondary Consumers:

- Carnivores that eat herbivores.

Example: Frog, fox.

4. Tertiary Consumers:

- Top carnivores that eat secondary consumers.

Example: Snake, eagle, lion.

5. Decomposers:

- Break down dead organisms and recycle nutrients back to the soil.

Example: Fungi, bacteria.

🌿 Definition of Food Web:

- A food web is a network of interconnected food chains in an ecosystem.
- It shows how different organisms eat more than one type of food, making the energy flow more complex and stable.

➡️ Example:

In a forest:

🌿 Grass ⟶ Grasshopper ⟶ Frog ⟶ Snake ⟶ Eagle

🌿 Grass ⟶ Rabbit ⟶ Fox ⟶ Eagle

🌿 Fruits ⟶ Mouse ⟶ Owl ⟶ Eagle

All these food chains are connected, forming a food web.

🌍 Ecological Importance of Food Chain and Food Web:

1. Energy Flow:

- They help transfer energy from the sun ⟶ producers ⟶ consumers ⟶ decomposers.

2. Nutrient Cycling:

- Decomposers recycle minerals and nutrients back into the soil for plants.

3. Maintaining Ecological Balance:

- Help keep population sizes stable — if one species decreases, others adjust naturally.

4. Stability of Ecosystem:

- A food web provides alternative food sources, ensuring survival of organisms even if one food chain is disturbed.

5. Interdependence:

- Show how all living things are linked together in nature.

✦ **Summary:**

- A food chain is a straight energy path, while a food web is a network of many food chains.
- Both represent feeding relationships and energy flow in an ecosystem.
- They are essential for maintaining balance, stability, and recycling in nature.

🌿 Without food chains and food webs, the ecosystem would collapse due to lack of energy transfer and nutrient recycling.

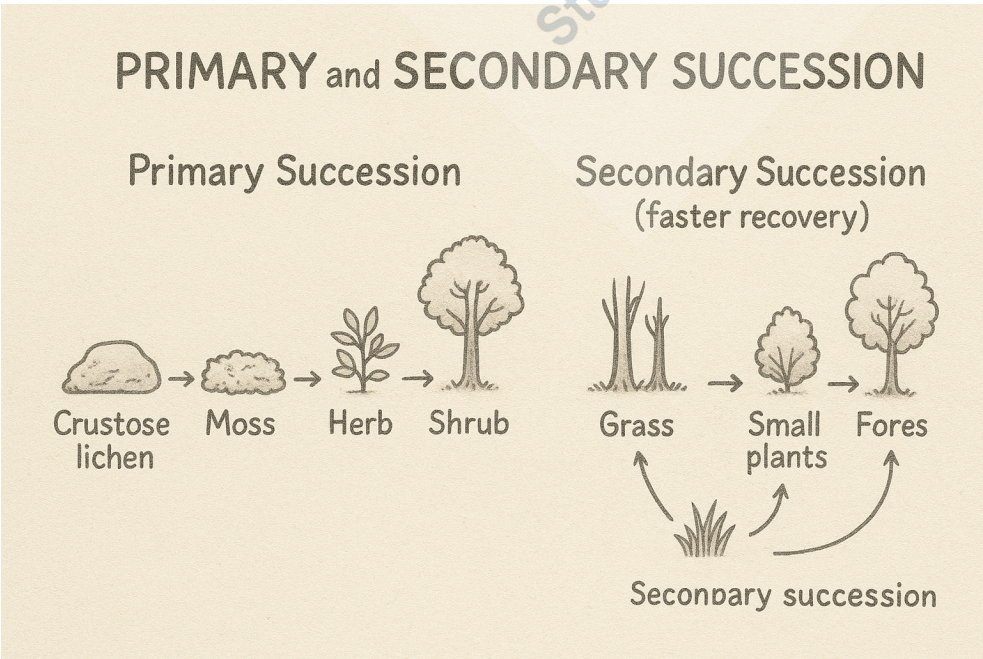
🌟 Q5: Differentiate between Primary Succession and Secondary Succession (with examples).

❖ Definition of Succession:

- Succession is a natural process of gradual change in the species composition of a community over time.
- It starts with simple organisms (pioneers) and ends with a stable, self-sustaining climax community.

👉 It can occur on land or water and takes place in two main forms — Primary and Secondary succession.

Diagram:



🌱 1. Primary Succession:

🔹 Definition:

- Primary succession takes place on bare land or newly formed habitats where no previous life existed.
- It is the beginning of life in a completely new environment — such as bare rock, sand, or volcanic area.

🔹 Example:

- Growth of plants on bare rocks formed by volcanic eruptions.
- Development of life in a new pond or glacial area.

🔹 Explanation:

- It begins with pioneer species like lichens and mosses that can survive in harsh conditions.
- These pioneers break down rocks into soil.
- **Gradually**, soil formation allows small plants, shrubs, and trees to grow, leading to a climax forest community.

🔹 Stages in Primary Succession (Xerosere Example):

1. Crustose Lichen Stage ⟶ First colonizers on bare rock.

2. Foliose Lichen Stage ⟶ Lichens make soil rough and porous.

3. Moss Stage ⟶ Mosses add humus and moisture.

4. Herb Stage ⟶ Small herbs begin to grow.

5. Shrub Stage ⟶ Bushes dominate and improve the soil.

6. Climax Forest ⟶ Stable forest with large trees forms.

- **Time Period:**

A very slow process — may take thousands of years to reach the climax stage.

🌾 2. Secondary Succession:

- **Definition:**

  - Secondary succession occurs in an area where life previously existed but was disturbed or destroyed by fire, flood, or human activity.
  - It happens where soil and some living organisms already exist.

🔹 **Example:**

- Regrowth of vegetation after a forest fire.
- Abandoned farmland turning back into grassland and forest.

🔹 **Explanation:**

- Since soil and seeds are already present, succession starts quickly.
- Grasses and weeds grow first, followed by shrubs and trees, restoring the climax community faster than primary succession.

🔹 **Time Period:**

- A faster process — may take hundreds (not thousands) of years.

⚖️ Major Differences Between Primary and Secondary Succession:

Main Differences in Explanation:

- **Primary succession** starts on a completely lifeless surface such as bare rock, while **secondary succession** begins in an area that already has soil and remnants of previous life. The pioneer species in **primary succession**

are lichens and mosses, while in **secondary succession**, the first plants are usually grasses and small herbs.
- **Primary succession** is slow because soil formation takes a long time, while **secondary succession** is rapid since the environment is already partly developed. **Primary succession** is common in new volcanic islands or glacier areas, whereas **secondary succession** occurs in burned forests or abandoned fields.

Both successions end in a climax community, but the time and starting conditions differ greatly.

🌍 Ecological Importance of Succession:

1. Helps restore damaged ecosystems naturally.

2. Increases biodiversity and stability of the environment.

3. Improves soil fertility and structure.

4. Maintains ecological balance and supports continuous life on Earth.

✦ **Summary:**

- **Primary succession** starts from bare rock (no life or soil) and is slow.
- **Secondary succession** starts from disturbed but fertile soil and is faster.

Both lead to the formation of a climax community, ensuring ecological recovery and balance in nature.

🌿 **In short,** succession is nature's way of healing itself and maintaining the continuity of life on Earth.

Note:

This chapter is designed to provide a solid foundation of knowledge, with the goal of deepening understanding and encouraging further exploration of the subject. The content has been carefully selected to support effective learning and inspire students to engage with the topic more deeply.

Author: Muhammad Asghar

Purpose: To contribute to education by offering insightful, valuable content that enhances learning and understanding.