

BT201 – ECOLOGY, BIODIVERSITY AND EVOLUTION II

FINAL TERM MOST IMPORTANT QUESTIONS

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GROUP LINK: <https://chat.whatsapp.com/BjC6W0jZx8o9yaC2lSh1Gu>

1. Give some examples of Symbiosis.

Symbiosis refers to a close and long-term interaction between two different species. Here are some examples:

Mutualism (both species benefit):

- **Bees and flowers:** Bees collect nectar and pollen from flowers for food, while helping pollinate the flowers, which is essential for their reproduction.
- **Oxpeckers and buffalo:** Oxpeckers feed on ticks and other parasites found on buffalo, benefiting from a food source, while the buffalo are rid of parasites.

Commensalism (one species benefits, the other is neither helped nor harmed):

- **Barnacles and whales:** Barnacles attach to the skin of whales, gaining access to nutrient-rich water while the whale swims, but the whale is generally unaffected.
- **Remoras and sharks:** Remoras attach to the skin of sharks and feed on scraps of food left behind, but sharks are not affected by this interaction.

Parasitism (one species benefits at the expense of the other):

- **Tapeworms and mammals:** Tapeworms live in the intestines of mammals, absorbing nutrients from the host, which can lead to malnutrition for the host.
- **Lice and humans:** Lice live on human blood and can cause irritation or even disease, benefiting from the blood, while harming the human host.

2. What are effects of habitat destruction?

Habitat destruction can have significant and far-reaching effects on ecosystems and the species that depend on them. Some of the key effects include:

- **Loss of Biodiversity:** As habitats are destroyed, the species that rely on them for food, shelter, and reproduction may become endangered or extinct. This leads to a decline in biodiversity, reducing the variety of life in an ecosystem.
- **Disruption of Ecosystem Services:** Natural habitats provide essential ecosystem services like air and water purification, carbon sequestration, pollination of crops, and soil fertility. Destruction of habitats compromises these services, affecting human health and agriculture.
- **Fragmentation of Ecosystems:** Habitat destruction often leads to the fragmentation of larger ecosystems into smaller, isolated patches. This makes it difficult for species to migrate, find mates, or access resources, reducing their chances of survival.
- **Climate Change:** Many habitats, such as forests and wetlands, play a role in regulating the climate by absorbing carbon dioxide. When these habitats are destroyed, it can exacerbate climate change by releasing stored carbon back into the atmosphere.

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- **Displacement of Species:** As their habitats are destroyed, species are forced to move to new areas, which may not be suitable for their survival. This can lead to increased competition for resources, predation, and conflicts between species.
- **Invasive Species:** Habitat destruction can create conditions that allow invasive species to thrive. These non-native species may outcompete or prey on native species, further disrupting the ecosystem.
- **Alteration of the Water Cycle:** Wetlands, forests, and other habitats play important roles in regulating the water cycle. Habitat destruction, especially in wetlands and forests, can disrupt rainfall patterns, leading to flooding or drought.

3. Define food web and its function in community.

A food web is a system of interlinked food chains in an ecosystem, showing the complex feeding relationships between different organisms. It illustrates how energy and nutrients are transferred through various trophic levels from producers to consumers and decomposers.

Functions of a Food Web in a Community:

- **Energy Flow:** Transfers energy from primary producers (plants, algae) through different consumer levels (herbivores, carnivores) and decomposers.
- **Nutrient Cycling:** Helps recycle nutrients through decomposers, returning essential elements to the ecosystem for reuse by producers.
- **Ecosystem Stability:** Provides resilience by offering alternative feeding pathways, reducing the impact of changes or species loss.
- **Population Control:** Regulates the population of species through predator-prey relationships, helping to maintain balance.
- **Biodiversity Support:** Promotes species diversity by offering various niches for different organisms to occupy.
- **Trophic Interactions:** Illustrates the various roles organisms play in the ecosystem, from producers to top predators, contributing to the functioning of the entire community.

4. What are keystone species?

Keystone species are organisms that have a disproportionately large impact on their ecosystem relative to their abundance or biomass. Their presence or role in an ecosystem significantly affects the structure, diversity, and functioning of the community. Removing or drastically reducing the population of a keystone species can lead to dramatic changes or even the collapse of the ecosystem.

Characteristics of Keystone Species:

- **Critical Role:** They play an essential role in maintaining the ecological balance of their ecosystem, such as regulating prey populations, controlling plant growth, or aiding nutrient cycling.
- **Disproportionate Impact:** Despite their relatively low numbers or biomass, their influence on the ecosystem is far greater than would be expected based on their size or population.
- **Ecosystem Regulation:** Keystone species often influence the abundance and diversity of other species in the community by controlling key ecological processes.

Examples of Keystone Species are Sea otters in kelp forests, Wolves in Yellowstone National Park and Beavers.

5. Write some reasons of phylogenetics.

Phylogenetics is the study of the evolutionary relationships among species or groups of organisms. The reasons for conducting phylogenetic studies are vast and contribute significantly to our understanding of biology, evolution, and biodiversity. Here are some key reasons for phylogenetics:

Understanding Evolutionary Relationships:

- Phylogenetics helps trace the evolutionary history and common ancestry of organisms. By constructing phylogenetic trees, scientists can determine how species are related to one another and how they have evolved over time.

Classification and Taxonomy:

- Phylogenetic studies provide a more natural way of classifying organisms based on their evolutionary history. This approach helps improve the accuracy of species classification and the organization of biological diversity.

Conservation and Biodiversity:

- Phylogenetics plays a crucial role in conservation efforts. Understanding the evolutionary relationships between species helps prioritize conservation efforts, especially for endangered species, and ensures the preservation of genetic diversity within ecosystems.

Tracing Disease Evolution:

- In fields like medicine, phylogenetics can be used to track the evolution and spread of pathogens, such as viruses or bacteria, allowing for better understanding and management of diseases (e.g., tracking the evolution of the COVID-19 virus).

Reconstructing Evolutionary Events:

- Phylogenetic studies enable scientists to reconstruct ancient evolutionary events, such as mass extinctions, migration patterns, and adaptation to changing environments, providing insights into Earth's biological history.

Fossil Interpretation:

- Phylogenetic analysis can also aid in interpreting fossil records by placing extinct species within the context of existing evolutionary trees, helping researchers understand how ancient species are related to modern organisms.

6. Differentiate between carnivores and detritivores.

Carnivores and detritivores are both types of consumers in an ecosystem, but they differ in their sources of food. Carnivores are organisms that primarily consume other animals for sustenance. They may hunt and kill prey (as predators) or scavenge the remains of dead animals (as scavengers). Carnivores are essential in controlling prey populations and maintaining balance in the food web. Examples include lions, hawks, and wolves. On the other hand, detritivores feed on dead organic matter, such as plant material, decaying bodies of animals, and other decomposing matter. They break down this material into smaller particles, contributing to the process of decomposition and nutrient recycling in ecosystems. Detritivores include organisms like earthworms, termites, and certain types of fungi. While carnivores focus on living or recently deceased animals, detritivores specialize in decomposing organic matter, helping to recycle nutrients back into the soil, which benefits producers like plants. Both types of organisms play crucial but distinct roles in maintaining ecosystem health.

7. Define Ecology, Ecological engineering and industrial ecology.

Ecology: The study of interactions between organisms and their environment, including how they adapt and interact within ecosystems.

Ecological Engineering: The design and construction of sustainable ecosystems that restore or maintain ecological balance, often to address environmental issues.

Industrial Ecology: The study of material and energy flows in industrial systems, aiming to reduce environmental impact by promoting sustainability and resource efficiency.

8. Define the term conjugation, transduction and transformation.

Conjugation: A process of genetic exchange in bacteria where two bacterial cells connect through a pilus, and genetic material (usually plasmids) is transferred from one cell to another.

Transduction: A method of genetic exchange in bacteria where a bacteriophage (virus) transfers genetic material from one bacterium to another during infection.

Transformation: A process by which a bacterium takes up foreign DNA from its surroundings, usually from dead or lysed bacteria, and incorporates it into its own genome.

9. Write general traits of Green Algae.

Green algae, a diverse group of photosynthetic organisms, share several general traits:

- **Pigments:** Green algae contain chlorophyll a and b, giving them their characteristic green color. These pigments help in photosynthesis, capturing light energy for the production of food.
- **Habitat:** They primarily live in freshwater environments, although some species are found in marine, terrestrial, and symbiotic habitats.
- **Cell Structure:** Green algae are typically unicellular, but many species form multicellular or colonial structures. Their cells have a simple structure, with a nucleus, chloroplasts, and a cell wall made of cellulose.
- **Reproduction:** Green algae reproduce both sexually and asexually. Asexual reproduction often occurs through the formation of spores or by simple cell division. Sexual reproduction involves the fusion of gametes, leading to the formation of a zygote.
- **Oxygen Production:** Like other photosynthetic organisms, green algae release oxygen as a byproduct of photosynthesis, contributing to the oxygen supply in aquatic ecosystems.
- **Size and Shape:** They vary greatly in size, from microscopic single-celled organisms to large, multicellular forms like *Cladophora* or *Ulva* (sea lettuce).

- **Economic Importance:** Green algae are important in food chains as primary producers and have various applications in biotechnology, such as biofuel production, food additives, and as sources of compounds for medicine.

10. Define herbivores and carnivores.

Herbivores are animals that primarily consume plant material for nutrition. They feed on various parts of plants, such as leaves, stems, fruits, and roots, depending on the species. Herbivores play a crucial role in ecosystems by controlling plant populations and contributing to the energy flow within food webs. Examples of herbivores include cows, elephants, and caterpillars. On the other hand, **carnivores** are animals that primarily feed on other animals, either by hunting and killing prey (predators) or scavenging dead animals (scavengers). Carnivores are essential in regulating the populations of prey species and maintaining the balance of ecosystems. Examples of carnivores include lions, wolves, and hawks. While herbivores primarily derive energy from plants, carnivores rely on the consumption of other animals for sustenance, forming an important link in the food chain.

11. Define translation and transcription.

Transcription: The process by which an RNA molecule is synthesized from a DNA template, transferring genetic information from DNA to RNA.

Translation: The process by which a protein is synthesized from an mRNA template, with the help of ribosomes and tRNA, translating genetic code into an amino acid sequence.

12. Explain Charles Lyell mistake in natural selection.

Charles Lyell, a prominent geologist, is known for his work on the principles of geology, particularly the idea of uniformitarianism, which suggests that the processes shaping the Earth today are the same as those that occurred in the past. While his work greatly influenced the field of geology and the understanding of Earth's history, Lyell made a mistake when it came to his understanding of natural selection.

Lyell did not fully embrace the concept of natural selection, which was later developed by Charles Darwin. Lyell initially believed that organisms gradually adapted to their environments through gradual changes over time, but he did not see natural selection as the primary mechanism for evolution. Instead, he thought that environmental changes could influence the development of species, but he underestimated the role of competition and survival of the fittest in driving evolutionary changes.

Lyell's mistake was his reluctance to accept that natural selection, rather than just gradual environmental change, was the key mechanism by which beneficial traits were passed on to future generations. It took Darwin's theory of natural selection to highlight that species evolve due to differential survival and reproduction of individuals with advantageous traits, shaped by environmental pressures over time.

13. Why freshwater ecosystems are more threatened?

Freshwater ecosystems are more threatened for several reasons:

- **Pollution:** Freshwater ecosystems are often subjected to pollution from agricultural runoff, industrial waste, sewage, and chemicals. This contamination degrades water quality, harms aquatic life, and disrupts ecosystem functions.

- **Water Extraction:** Overuse of freshwater resources for agriculture, industry, and drinking water significantly depletes water sources. This reduces the availability of water for aquatic organisms and alters natural habitats, leading to the decline of species that depend on these ecosystems.
- **Habitat Destruction:** Urbanization, dam construction, and land development around freshwater habitats lead to habitat fragmentation and destruction. Wetlands, rivers, lakes, and streams are drained or altered, disrupting the biodiversity and balance of these ecosystems.
- **Climate Change:** Climate change affects precipitation patterns, leading to altered river flows, increased evaporation, and changes in water temperature. These shifts can harm species adapted to specific environmental conditions, leading to changes in species composition and loss of biodiversity.
- **Invasive Species:** Invasive species can outcompete or prey on native species in freshwater ecosystems, disrupting food webs and ecosystem functions. These species often thrive in disturbed environments and can cause long-term damage to the ecosystem.
- **Overfishing:** Excessive fishing in freshwater bodies leads to the depletion of fish populations, which can disrupt the food web and harm other species that rely on fish for food.
- **Eutrophication:** Nutrient overloading, mainly from fertilizers, leads to eutrophication, where excessive nutrients cause algae blooms. These blooms deplete oxygen levels, harming aquatic life and causing "dead zones" in lakes and rivers.

14. Define aquatic and terrestrial ecosystem.

Aquatic Ecosystem: An ecosystem that is based in water, including both freshwater (rivers, lakes, wetlands) and marine (oceans, coral reefs) environments, where organisms live and interact with the water.

Terrestrial Ecosystem: An ecosystem that exists on land, characterized by specific climate conditions and plant and animal life, such as forests, grasslands, deserts, and tundras.

15. Define clade and cladistics.

Clade: A group of organisms that includes a common ancestor and all its descendants, representing a single branch on the tree of life.

Cladistics: A method of classifying organisms based on shared derived characteristics (synapomorphies) to establish evolutionary relationships and build a phylogenetic tree.

16. What is sustainability?

Sustainability refers to the ability to meet the needs of the present without compromising the ability of future generations to meet their own needs. It involves managing resources in a way that maintains ecological balance, promotes social well-being, and ensures economic stability over the long term. Sustainability encompasses environmental, social, and economic dimensions, aiming for a harmonious coexistence of these factors to create a resilient and thriving planet for future generations.

17. Write importance of bacteria and fungi.

Importance of Bacteria:

1. **Decomposers:** Bacteria play a vital role in breaking down organic matter, recycling nutrients like carbon, nitrogen, and sulfur back into the ecosystem.

2. **Nitrogen Fixation:** Certain bacteria, such as *Rhizobium*, convert atmospheric nitrogen into a usable form for plants, which is essential for plant growth and the nitrogen cycle.
3. **Food Production:** Bacteria are used in the production of foods like yogurt, cheese, and fermented products, where they aid in fermentation and preservation.
4. **Medicine:** Some bacteria produce antibiotics (like *Streptomyces*) and other compounds that are crucial in treating infections and diseases.
5. **Bioremediation:** Bacteria can be used to clean up environmental pollutants, such as oil spills or toxic waste, by breaking down harmful substances into less toxic compounds.
6. **Symbiotic Relationships:** Many bacteria live in symbiotic relationships with humans and other organisms, such as the gut bacteria that help in digestion.

Importance of Fungi:

1. **Decomposers:** Fungi break down dead organic matter, recycling nutrients into the ecosystem and helping maintain soil health.
2. **Symbiotic Relationships:** Fungi form mutualistic relationships with plants (mycorrhizae), aiding in nutrient absorption, especially phosphorus, while benefiting from the plant's sugars.
3. **Medicine:** Fungi, like *Penicillium*, are the source of antibiotics and other medical treatments, such as immunosuppressive drugs.
4. **Food Production:** Fungi are used in the production of food items like bread (yeast), beer, and certain types of cheese, as well as in fermentation processes.
5. **Biotechnology:** Fungi are used in various industrial processes, including the production of enzymes, biofuels, and other valuable products.
6. **Biodiversity:** Fungi contribute to biodiversity by occupying various ecological niches, providing habitats for other organisms, and forming the basis of certain food chains.

18. Write effects of Exotic Predator on food web.

Exotic predators can disrupt food webs by:

1. Reducing native prey populations, leading to imbalances.
2. Altering species interactions, affecting the entire ecosystem.
3. Triggering trophic cascades, changing the abundance of species at various levels.
4. Competing with native predators, potentially causing their decline.
5. Reducing biodiversity, as native species may struggle to adapt.
6. Disrupting ecosystem services, such as pollination and water filtration.

19. How nutrients are influenced by humans?

Humans influence nutrient cycles in various ways, often leading to imbalances in ecosystems. Agricultural activities, such as the use of synthetic fertilizers, significantly increase the amount of nitrogen and phosphorus in the environment, leading to nutrient runoff into water bodies. This can cause eutrophication, where excess nutrients lead to algae blooms and oxygen depletion, harming aquatic life. Urbanization and industrial activities also contribute to nutrient imbalances by discharging pollutants like heavy metals, sewage, and chemicals into ecosystems. Deforestation and land-use changes can disrupt natural nutrient cycles by reducing the amount of organic matter returned to the soil. Overfishing can deplete marine nutrient cycles, and the burning of fossil fuels increases carbon dioxide levels, affecting global nutrient dynamics. These human-driven changes often result in soil degradation, water pollution, and the

disruption of natural ecosystems, highlighting the need for sustainable practices to maintain nutrient balance.

20. Define photon flux.

Photon flux refers to the rate at which photons (light particles) pass through a given area in a specific amount of time. It is a measure of the intensity of light and is typically expressed in photons per second per square meter (photons/s·m²). Photon flux is important in fields like photosynthesis, where it indicates the amount of light available to organisms for energy conversion, and in various scientific applications involving light or electromagnetic radiation.

21. What is logistic population growth?

Logistic population growth is a model that describes how a population grows in an environment with limited resources. Initially, the population grows rapidly when resources are abundant. However, as the population size approaches the carrying capacity of the environment (the maximum number of individuals the environment can support), the growth rate slows down and eventually stabilizes. This results in an S-shaped curve (logistic curve) when population size is plotted over time. The growth rate is affected by factors such as competition for resources, predation, disease, and other environmental constraints.

22. Define DNA, RNA and protein sequence.

DNA (Deoxyribonucleic Acid): DNA is the molecule that carries genetic information in living organisms. It consists of two strands twisted into a double helix, with each strand made up of nucleotides containing a sugar (deoxyribose), phosphate group, and nitrogenous bases (adenine, thymine, cytosine, and guanine). DNA serves as a template for RNA synthesis in the process of transcription.

RNA (Ribonucleic Acid): RNA is a single-stranded molecule that plays a key role in the process of protein synthesis. It is made up of nucleotides containing a sugar (ribose), phosphate group, and nitrogenous bases (adenine, uracil, cytosine, and guanine). RNA is synthesized from DNA during transcription and is used to create proteins through translation.

Protein Sequence: A protein sequence refers to the specific order of amino acids in a polypeptide chain, which is determined by the sequence of codons in messenger RNA (mRNA). The sequence of amino acids in a protein dictates its structure and function, and the protein is synthesized during the process of translation, where the mRNA sequence is translated into a corresponding amino acid chain.

23. Why zoo is called dead land?

A zoo is sometimes called a "dead land" because it provides an unnatural environment for animals, limiting their natural behaviours like hunting and foraging. The confined spaces and lack of biodiversity make it feel disconnected from the dynamic ecosystems found in the wild, often leading to stress and a loss of the ecological interactions that occur in natural habitats.

24. Write a short note on flightless birds.

Flightless birds are species that have lost the ability to fly due to evolutionary adaptations. These birds typically have small wings or no wings at all, and their bodies are often adapted for running, swimming, or diving. Flightless birds are found in a variety of ecosystems, from grasslands to islands. Examples include the ostrich, which is the largest and fastest-running bird, and the penguin, which is an excellent

swimmer. The loss of flight in these birds is often due to the absence of predators, the need to conserve energy, or adaptation to specific environments. Despite their inability to fly, many flightless birds are strong runners or swimmers and have evolved unique traits suited to their habitats.

25. Define Binomial Nomenclature.

Binomial Nomenclature is a system of naming species using two Latin or Latinized words: the first word represents the genus and is capitalized, while the second word represents the species and is written in lowercase. This system, developed by Carl Linnaeus, helps to provide a standardized, universally recognized way of identifying and classifying organisms. For example, in the name *Homo sapiens*, *Homo* is the genus, and *sapiens* is the species.

26. Write importance of biodiversity in the food and human health.

Importance of Biodiversity in Food:

1. **Diverse Food Sources:** Biodiversity ensures a variety of crops, livestock, and fish species, providing essential nutrients and dietary diversity for human populations.
2. **Crop Resilience:** Genetic diversity within plant species helps crops adapt to changing environmental conditions, pests, and diseases, ensuring food security.
3. **Sustainable Agriculture:** A diverse range of species supports agroecosystems, promoting soil fertility, pollination, and natural pest control, which are essential for sustainable farming.

Importance of Biodiversity in Human Health:

1. **Medicinal Resources:** Many medicines are derived from plants, animals, and microorganisms. Biodiversity provides raw materials for pharmaceuticals and treatments for diseases.
2. **Ecosystem Services:** Healthy ecosystems regulate air, water, and soil quality, supporting overall public health by reducing disease transmission and promoting clean environments.
3. **Disease Resistance:** Genetic diversity within species can lead to the development of resistance to diseases, benefiting both humans and other species.

27. What is photosynthetic response?

Photosynthetic response refers to how plants and other photosynthetic organisms react to different environmental factors that influence the rate of photosynthesis. These factors include light intensity, carbon dioxide concentration, temperature, and water availability. The response can be measured by the rate at which photosynthesis occurs under varying conditions. For example, as light intensity increases, the photosynthetic rate also rises until it reaches a saturation point. Similarly, temperature affects enzyme activity, and carbon dioxide availability can enhance or limit photosynthesis. Understanding photosynthetic response is crucial in agriculture and ecology to optimize plant growth and productivity.

28. What are three main sources of energy?

The three main sources of energy are:

1. **Solar Energy** – Energy from the Sun, which drives photosynthesis, provides heat, and can be harnessed for electricity through solar panels.
2. **Fossil Fuels** – Non-renewable energy sources like coal, oil, and natural gas, formed from ancient organic matter and widely used for electricity, heating, and transportation.

3. **Renewable Energy** – Includes wind, hydro (water), geothermal, and biomass energy, which are sustainable and have lower environmental impacts compared to fossil fuels.

29. What are shared ancestral characters?

Shared ancestral characters are traits that originated in a common ancestor and are inherited by multiple descendant species. These traits are not unique to a specific group but are found in broader taxonomic groups. For example, the presence of a backbone in vertebrates is a shared ancestral character because it was inherited from a common ancestor of all vertebrates. Such traits help in understanding evolutionary relationships but do not distinguish between closely related groups.

30. What are advantages of being multi celled?

The advantages of being multicellular include:

1. **Specialization of Cells** – Different cells perform specific functions (e.g., nerve cells for signalling, muscle cells for movement), improving efficiency.
2. **Larger Size** – Multicellular organisms can grow larger, helping with defence, resource competition, and predation.
3. **Complex Structures** – They can develop organs and systems for better survival, such as circulatory and digestive systems.
4. **Increased Lifespan** – Damage to individual cells does not necessarily harm the whole organism, allowing for longer survival.
5. **Adaptability** – Multicellular organisms can adapt to various environments by evolving specialized structures and behaviours.

31. Write examples of foundation species.

Examples of foundation species include:

1. **Coral (e.g., *Acropora species*)** – Forms coral reefs, providing habitat and protection for marine life.
2. **Kelp (e.g., *Macrocystis pyrifera*)** – Creates underwater kelp forests, supporting diverse marine ecosystems.
3. **Mangrove Trees (e.g., *Rhizophora species*)** – Stabilize coastlines, prevent erosion, and provide shelter for aquatic species.
4. **Oak Trees (e.g., *Quercus species*)** – Support Forest ecosystems by providing food, shelter, and oxygen.
5. **Seagrass (e.g., *Zostera species*)** – Forms underwater meadows, helping in carbon sequestration and marine biodiversity.

32. What is Sigmoidal growth?

Sigmoidal growth refers to an S-shaped (sigmoid) population growth pattern where the population initially grows slowly, then rapidly increases, and finally levels off as it reaches the carrying capacity of the environment. This type of growth follows the logistic growth model and occurs in three phases:

1. **Lag Phase** – Slow population growth due to a small number of individuals.
2. **Exponential Phase** – Rapid population increase as resources are abundant.
3. **Stationary Phase** – Growth slows and stabilizes as resources become limited and environmental resistance increases.

33. Write three categories of genomic classification.

The three categories of genomic classification are:

1. **Structural Genomics** – Focuses on the physical structure of genomes, including DNA sequencing, gene mapping, and chromosome organization.
2. **Functional Genomics** – Studies gene functions and interactions, analyzing how genes and proteins work together within a biological system.
3. **Comparative Genomics** – Compares genomes of different species to understand evolutionary relationships, genetic variations, and species-specific traits.

34. Is human a keystone species? Explain.

Yes, humans can be considered a keystone species because they have a profound impact on ecosystems, influencing biodiversity, species interactions, and environmental stability. Humans shape ecosystems through activities like agriculture, urbanization, deforestation, and conservation efforts. Unlike traditional keystone species, which naturally regulate ecosystems (e.g., wolves controlling prey populations), humans both positively and negatively alter ecosystems on a global scale. While some human actions lead to habitat destruction and species extinction, others, such as reforestation and wildlife protection, help maintain ecological balance. Therefore, humans function as a keystone species due to their significant and widespread influence on the environment.

35. Which trait breeders want to be bred in crop?

Crop breeders aim to develop and enhance specific traits in crops to improve yield, quality, and resilience. Key traits include:

1. **High Yield** – To produce more food per unit area.
2. **Pest and Disease Resistance** – To reduce crop losses and minimize pesticide use.
3. **Drought and Heat Tolerance** – To ensure growth in harsh climates.
4. **Nutritional Quality** – To enhance vitamins, minerals, and protein content (e.g., biofortified crops like Golden Rice).
5. **Faster Growth and Early Maturity** – To increase cropping cycles and food production.
6. **Better Taste and Shelf Life** – To improve consumer appeal and reduce food waste.
7. **Herbicide Resistance** – To allow effective weed control without harming the crop.

36. What factors effect decomposition?

Several factors affect decomposition, influencing the breakdown of organic matter into simpler substances. These include:

1. **Temperature** – Warmer temperatures accelerate microbial activity, speeding up decomposition, while cold temperatures slow it down.
2. **Moisture** – Adequate water availability enhances microbial and fungal activity, whereas dry conditions slow decomposition.
3. **Oxygen Availability** – Aerobic decomposition (with oxygen) is faster and produces fewer odors, while anaerobic decomposition (without oxygen) is slower and results in methane production.
4. **Type of Organic Matter** – Materials rich in lignin (e.g., wood) decompose more slowly than those rich in sugars and proteins (e.g., leaves or fruits).
5. **Microbial and Fungal Activity** – The presence of decomposers, such as bacteria, fungi, and detritivores, accelerates the breakdown process.

6. **Soil Composition and pH** – Nutrient-rich, well-aerated, and neutral to slightly acidic soils support faster decomposition.
7. **Presence of Detritivores** – Organisms like earthworms, insects, and fungi help break down organic matter efficiently.

37. Define notochord.

A notochord is a flexible, rod-like structure found in the embryos of all chordates (a group that includes vertebrates). It provides support to the developing organism and serves as a precursor to the vertebral column (spine) in vertebrates. The notochord is located along the body's length, beneath the nervous system, and in many species, it is replaced by the vertebral column as the organism matures. In some animals, such as lampreys and certain invertebrates, the notochord remains throughout adulthood.

38. Define plant breeding.

Plant breeding is the scientific practice of developing new plant varieties with desired traits, such as improved yield, disease resistance, better nutritional quality, or environmental tolerance. It involves the selection, crossbreeding, and genetic manipulation of plants to enhance specific characteristics. Plant breeding can be done through traditional methods (like cross-pollination) or modern techniques (like genetic modification or gene editing) to produce crops that meet agricultural, economic, and environmental needs.

39. Why life on earth depends upon Oxidation and Reduction Reaction?

Life on Earth depends on oxidation and reduction reactions (also known as redox reactions) because they are fundamental to energy production and various biological processes. Here's why they are crucial:

1. **Cellular Respiration:** Redox reactions are central to cellular respiration, the process by which cells convert nutrients (like glucose) into usable energy (ATP). During this process, glucose is oxidized (losing electrons), and oxygen is reduced (gaining electrons), providing energy for cellular functions.
2. **Photosynthesis:** In plants, redox reactions are essential for photosynthesis, where carbon dioxide is reduced (gaining electrons) to form glucose, while water is oxidized (losing electrons) to produce oxygen. This process sustains life by converting solar energy into chemical energy.
3. **Metabolism:** Oxidation and reduction reactions are involved in numerous metabolic pathways that break down molecules for energy, synthesize necessary biomolecules, and regulate cellular functions.
4. **Detoxification:** Redox reactions help detoxify harmful substances in the body, such as the breakdown of metabolic waste products, aiding in the maintenance of a stable internal environment (homeostasis).

40. How to use Prey and Predator for a balanced ecosystem?

Predator-prey dynamics help maintain ecosystem balance by:

1. **Regulating Populations:** Predators control prey numbers, preventing overpopulation and resource depletion.
2. **Preserving Biodiversity:** Predators prevent any single species from dominating, promoting a variety of life.
3. **Supporting Healthy Vegetation:** By controlling herbivores, predators allow plant growth and ecosystem regeneration.
4. **Natural Pest Control:** Predators help control pest species, reducing the need for pesticides.

5. **Driving Evolution:** Predator-prey interactions lead to adaptive changes in species, supporting ecological stability.

41. What is Endosymbiotic theory?

The Endosymbiotic theory proposes that certain organelles in eukaryotic cells, specifically mitochondria and chloroplasts, originated from free-living prokaryotic cells that were engulfed by an ancestral eukaryotic cell. According to this theory, these engulfed prokaryotes formed a symbiotic relationship with the host cell, eventually evolving into the organelles we see today.

Evidence supporting this theory includes:

1. Mitochondria and chloroplasts have their own DNA, similar to bacterial DNA.
2. These organelles reproduce independently through binary fission, like bacteria.
3. They have double membranes, consistent with the engulfing process.
4. Their ribosomes resemble those of prokaryotes.

42. Define Hibernation with example.

Hibernation is a state of prolonged dormancy or inactivity that some animals enter during cold weather to conserve energy. During hibernation, an animal's metabolic rate, body temperature, and heart rate drop significantly, allowing it to survive periods when food is scarce.

An example of hibernation is the brown bear. In winter, brown bears enter a hibernation-like state, where they don't eat, drink, or urinate, surviving off stored body fat until the warmer months.

43. Define Monophyletic, Polyphyletic and Paraphyletic.

Monophyletic: A group of organisms that includes a common ancestor and all of its descendants. It represents a single "branch" on the evolutionary tree, with all members sharing a common origin. Example: The class Mammalia (all mammals share a common ancestor).

Polyphyletic: A group of organisms that does not include the most recent common ancestor of all members of the group. It is formed based on similar traits rather than evolutionary relationships. Example: Flying animals (birds, bats, and insects) form a polyphyletic group since their common ancestor did not have wings.

Paraphyletic: A group that includes a common ancestor and some, but not all, of its descendants. It excludes certain descendants, which makes it incomplete. Example: Reptiles (excluding birds) form a paraphyletic group because birds are descended from reptiles but are not included.

44. Write importance of Protists.

Importance of Protists:

1. **Ecological Roles:** Protists play crucial roles in ecosystems as producers, consumers, and decomposers. Photosynthetic protists like algae produce oxygen and serve as the base of aquatic food webs.
2. **Nutrient Recycling:** As decomposers, protists break down organic matter, recycling nutrients and maintaining soil and water health.
3. **Symbiotic Relationships:** Many protists form mutualistic relationships, such as those in the guts of animals like termites, aiding in digestion, or with corals, helping them survive in nutrient-poor waters.

4. **Health and Medicine:** Some protists are used in research and biotechnology. Others, like *Plasmodium* (causing malaria) and *Trypanosoma* (causing sleeping sickness), are important pathogens, and studying them helps in developing treatments.
5. **Food Source:** Marine protists, especially algae, are a major food source for many aquatic organisms and are also used by humans for food and industrial products (e.g., agar, alginate).

45. Define Euglenoids and Diatoms.

Euglenoids: Euglenoids are a group of single-celled protists, typically found in freshwater environments. They have both plant-like and animal-like characteristics. Euglenoids possess chloroplasts for photosynthesis, but they can also move and feed heterotrophically. They have a unique structure called a pellicle, which provides flexibility. An example is *Euglena*.

Diatoms: Diatoms are a group of algae with a distinctive cell wall made of silica, forming intricate, glass-like patterns. They are primarily aquatic and can be found in both freshwater and marine environments. Diatoms are important producers in ecosystems, contributing to oxygen production through photosynthesis. Their silica shells contribute to the formation of diatomaceous earth.

46. Write causes of African Sleeping Sickness, Malaria and Dysentery.

1. African Sleeping Sickness (Trypanosomiasis):

Cause: The disease is caused by the *Trypanosoma* parasite, which is transmitted through the bite of an infected tsetse fly (genus *Glossina*). The parasite affects the nervous system, leading to symptoms such as fever, headache, and fatigue, eventually causing neurological damage and sleep disturbances.

2. Malaria (Plasmodium):

Cause: Malaria is caused by *Plasmodium* parasites (e.g., *Plasmodium falciparum*, *Plasmodium vivax*). It is transmitted through the bite of infected *Anopheles* mosquitoes. The parasite infects red blood cells, leading to symptoms such as fever, chills, and anaemia.

3. Dysentery:

Cause: Dysentery is caused by either bacterial or amoebic infections:

- **Bacterial Dysentery:** Caused by *Shigella* bacteria, transmitted through contaminated food, water, or contact with infected individuals.
- **Amoebic Dysentery:** Caused by the *Entamoeba histolytica* protozoan, transmitted via contaminated water or food. Both types cause inflammation of the intestines, leading to symptoms like diarrhea, abdominal pain, and dehydration.

47. What are shared and derived ancestral characters?

Shared ancestral characters (also called sympleisiomorphies) are traits that are present in a common ancestor and are inherited by multiple descendants, but are not unique to any particular group. These traits are found across broader taxonomic categories and help in understanding evolutionary relationships but don't distinguish between closely related groups. For example, having a backbone is a shared ancestral trait among all vertebrates.

Derived ancestral characters (or apomorphies) are traits that have evolved in a particular lineage after diverging from a common ancestor. These traits are unique to specific groups and distinguish them from others. For example, feathers are a derived trait of birds, distinguishing them from other vertebrates. Derived traits are used to identify evolutionary relationships and classify organisms more precisely.

48. What are methods of Gene transfer in bacteria?

The three main methods of gene transfer in bacteria are:

1. **Transformation:** This occurs when bacteria take up free-floating DNA from their environment, often released by other dead bacteria. The DNA is then incorporated into the bacterial genome.
2. **Conjugation:** In conjugation, bacteria transfer genetic material directly from one bacterium to another through a physical connection known as a pilus. This is typically a plasmid, a small, circular DNA molecule.
3. **Transduction:** Transduction involves the transfer of bacterial DNA from one bacterium to another via a virus (bacteriophage). The bacteriophage accidentally incorporates bacterial DNA into its viral genome and transfers it to another bacterium when it infects it.

49. Explain Coral Reefs as foundation species.

Coral reefs are considered foundation species because they play a crucial role in shaping and supporting entire marine ecosystems. Coral reefs are built by colonies of tiny marine organisms called coral polyps, which secrete calcium carbonate to form the hard, structural foundation of the reef. Here's how they function as foundation species:

1. **Habitat Creation:** Coral reefs provide complex and diverse habitats for a wide variety of marine species, including fish, mollusks, and invertebrates. The physical structure of the reef offers shelter, breeding grounds, and protection from predators.
2. **Biodiversity Support:** Coral reefs are among the most biodiverse ecosystems on Earth, hosting around 25% of all marine species despite covering less than 1% of the ocean floor. Their presence supports a wide range of species, from small invertebrates to large fish.
3. **Ecosystem Stability:** As foundation species, corals help stabilize the ecosystem by promoting nutrient cycling, supporting fish populations, and maintaining the balance of the surrounding marine environment.
4. **Economic Importance:** Coral reefs are vital for local economies, providing resources for fishing, tourism, and coastal protection. They act as natural barriers against storm surges, protecting coastal areas from erosion and damage.

50. Explain reproduction in Annelids.

Annelids, a group of segmented worms, reproduce both sexually and asexually, depending on the species. Most annelids have separate sexes, although some are hermaphroditic, meaning they possess both male and female reproductive organs. In sexual reproduction, two hermaphroditic individuals or individuals of different sexes align their bodies and exchange sperm. External fertilization typically occurs, with eggs fertilized by sperm in the surrounding environment. After fertilization, the eggs develop into larvae, which later undergo metamorphosis to become adult annelids. Some annelids, such as earthworms, also reproduce asexually through fragmentation. In this case, a piece of the worm's body can regenerate into a new individual, allowing for rapid population growth. Overall, annelid reproduction ensures genetic diversity through sexual reproduction and can also adapt to changing environmental conditions via asexual methods.

51. Write disadvantages of single celled.

Some disadvantages of single-celled organisms include:

1. **Limited Complexity:** Single-celled organisms lack the complexity and specialization seen in multicellular organisms. They rely on simpler mechanisms to perform all life functions, which can limit their adaptability and survival in certain environments.
2. **Vulnerability:** Single-celled organisms are more susceptible to environmental changes, toxins, and physical damage. A single adverse condition, like a lack of nutrients or extreme temperature, can kill the entire organism since it has no backup cells or systems.
3. **Limited Size:** Being microscopic, single-celled organisms are generally restricted in size, which limits their ability to perform complex tasks and acquire larger amounts of resources.
4. **Dependence on External Factors:** Single-celled organisms are entirely dependent on their immediate environment for all resources, such as nutrients and energy. Any disruption in these factors can have immediate, detrimental effects on the organism.
5. **Limited Genetic Diversity:** Many single-celled organisms reproduce asexually, leading to offspring that are genetically identical to the parent. This lack of genetic diversity can make populations more vulnerable to diseases and environmental changes.

52. Enlist Stop codons.

The three stop codons in the genetic code are:

1. UAA (Ochre)
2. UAG (Amber)
3. UGA (Opal)

53. How to document genetic history in genome?

To document genetic history in a genome:

1. **Sequence the Genome:** Obtain the full DNA sequence of an organism.
2. **Identify Genetic Variations:** Detect mutations like SNPs and insertions/deletions that reflect evolutionary changes.
3. **Phylogenetic Analysis:** Compare genomes across species to trace evolutionary relationships.
4. **Track Mutations:** Monitor genetic changes over generations to study adaptations and diseases.
5. **Use Databases:** Store and compare genomic data in databases like GenBank.
6. **Bioinformatics Tools:** Analyze data using software to correlate genetic changes with traits.

54. Explain Optimal Foraging Theory.

Optimal Foraging Theory is a concept in ecology that suggests animals forage in a way that maximizes their net energy intake per unit of foraging effort. According to this theory, animals seek to balance the energy they gain from food with the energy they expend in obtaining it. The goal is to optimize feeding efficiency to enhance survival and reproduction.

Key aspects of the theory include:

1. **Energy Maximization:** Animals choose food sources that provide the most energy relative to the effort required to obtain them. This often involves selecting prey or plants that offer the highest energy yield for the least amount of time and energy spent.

2. **Cost-Benefit Analysis:** The animal assesses the costs of foraging (time, energy, risk of predation) against the benefits (nutritional gain) of different food options. They will adjust their foraging behavior to minimize costs and maximize rewards.
3. **Diet Choices:** Animals may alter their diet based on availability of food sources. For example, an animal may opt for a less optimal food source if the preferred food is scarce.

55. Define Species Richness.

Species richness refers to the number of different species present in a given area or ecosystem. It is a measure of biodiversity that simply counts how many unique species are found in a specific location, without considering their abundance or distribution. High species richness typically indicates a diverse and healthy ecosystem, whereas low species richness may suggest an ecosystem that is less diverse or potentially facing environmental stress.

56. Explain contributions of Lamarck towards evolution.

Jean-Baptiste Lamarck made significant contributions to the theory of evolution through his Lamarckism theory, which proposed that species evolve through the inheritance of acquired characteristics. His key ideas include:

1. **Use and Disuse:** Traits that are used more frequently by an organism become stronger and more developed, while those that are not used diminish over time.
2. **Inheritance of Acquired Traits:** These traits, acquired during an organism's lifetime (e.g., a giraffe's neck growing longer from stretching), could be passed on to offspring.

Although Lamarck's ideas were later replaced by Darwin's theory of natural selection, his work was important in suggesting that species change over time and influenced the development of evolutionary biology.

57. Is replication involved in formation of RNA from DNA?

No, replication is not involved in the formation of RNA from DNA. The process responsible for the formation of RNA from DNA is called transcription. During transcription, a segment of DNA is used as a template to synthesize a complementary RNA molecule, specifically messenger RNA (mRNA), which then carries genetic information to the ribosomes for protein synthesis.

58. Write mechanism of Prokaryotic evolution.

Prokaryotic evolution occurs through:

1. **Mutation:** Random genetic changes that can introduce new traits.
 2. **Horizontal Gene Transfer:** Includes transformation (DNA uptake), conjugation (DNA transfer between cells), and transduction (virus-mediated DNA transfer).
 3. **Natural Selection:** Beneficial traits increase in frequency, aiding survival.
 4. **Genetic Drift:** Random changes in gene frequencies, especially in small populations.
 5. **Recombination:** Movement of genetic material within the genome, leading to variation.
- These mechanisms allow prokaryotes to adapt and evolve rapidly.

59. Phylum Arthropoda is a diverse group. Discuss.

Phylum Arthropoda is one of the most diverse and abundant groups in the animal kingdom, encompassing species found in nearly every habitat on Earth. Key characteristics that contribute to its diversity include:

1. **Exoskeleton:** Arthropods have a hard, segmented exoskeleton made of chitin that provides protection and support while allowing for mobility. This exoskeleton is periodically shed through a process called molting, allowing growth.
2. **Segmentation:** The body of arthropods is segmented into distinct regions (e.g., head, thorax, abdomen), with each segment often having specialized functions. This segmentation allows for the evolution of various body forms and functions.
3. **Jointed Appendages:** Arthropods have jointed limbs that allow for efficient movement and a variety of specialized functions, such as walking, swimming, feeding, and reproduction.
4. **Bilateral Symmetry:** They exhibit bilateral symmetry, which means their body is symmetrical along a central axis, aiding in their efficient movement and coordination.
5. **Respiratory Systems:** Arthropods have a variety of respiratory systems, such as gills, tracheae, or book lungs, depending on their environment, allowing them to occupy diverse habitats.
6. **Diversity of Species:** The phylum includes a vast range of species, from microscopic mites and ticks to large insects like beetles and butterflies, as well as crustaceans like crabs and lobsters, and arachnids like spiders and scorpions.
7. **Ecological Roles:** Arthropods play vital roles in ecosystems as pollinators, decomposers, predators, and prey. They are also important for human industries in agriculture, medicine, and biotechnology.

60. How exotic predators disturb the structure of food web?

Exotic predators disrupt food webs by:

1. **Displacing Native Species:** They outcompete or prey on native species, leading to population declines.
 2. **Trophic Cascades:** Their predation can cause imbalances in the ecosystem, affecting multiple species.
 3. **Altered Species Interactions:** They may change the feeding habits or reproduction of native species.
 4. **New Diseases:** Exotic predators can introduce pathogens that harm native species.
 5. **Resource Competition:** They compete for food, impacting native predators and prey.
- These disruptions destabilize ecosystems and affect biodiversity.

61. Differentiate between maximum parsimony and likelihood.

Maximum Parsimony (MP) is a phylogenetic method that seeks the tree with the fewest evolutionary changes, assuming that the simplest explanation is the most likely. It evaluates all possible tree configurations and selects the one that minimizes character state changes. This approach is computationally simpler but can be less accurate when mutation rates vary or are uneven across different sites or lineages.

Likelihood is a more advanced phylogenetic method that calculates the probability of observing the given data for different tree structures, considering models of evolution that account for varying mutation rates and other factors. It selects the tree that maximizes this probability, offering a more accurate representation of evolutionary relationships, though it requires more computational resources and a clear model of sequence evolution.

62. Define subphylum Chelicerata.

Subphylum Chelicerata is a group within the phylum Arthropoda that includes animals with a unique body structure characterized by the presence of chelicerae (specialized mouthparts used for feeding, often fang-like or pincer-like), and a body divided into two main segments: the cephalothorax (a fused head and thorax) and the abdomen. This subphylum includes arachnids like spiders, scorpions, ticks, mites, and horseshoe crabs. Members of Chelicerata lack antennae, which differentiates them from other arthropods, and typically have four pairs of legs. They are primarily terrestrial, though some, like horseshoe crabs, are aquatic.

63. What happens when organisms have limited access to resources?

When organisms have limited access to resources, they may experience competition for food and shelter, leading to reduced growth and reproduction. Over time, they may adapt to the scarcity, or in extreme cases, face population decline or extinction. Some may also exhibit behavioural changes like shifting feeding habits or migrating to better areas.

64. What are transposons?

Transposons, also known as jumping genes, are DNA sequences that can move or "jump" from one location to another within the genome. They can insert themselves into different parts of the chromosome, sometimes causing mutations or changes in gene expression. Transposons are classified into two types: Class I (retrotransposons), which move via an RNA intermediate, and Class II (DNA transposons), which move directly as DNA. This movement can affect genetic diversity and evolution by rearranging genetic material.

65. Define polyphyletic ancestors.

Polyphyletic ancestors refer to a group of organisms that are derived from multiple, unrelated evolutionary lineages, meaning they do not share a common recent ancestor. In a polyphyletic group, the members are more distantly related than they are to other groups, and their characteristics may have evolved independently from different ancestors. This contrasts with monophyletic (single common ancestor) and paraphyletic (common ancestor but excluding some descendants) groups in evolutionary biology.

66.