

IB Environmental Systems and Societies (ESS) Practice Exam (Sample)

Study Guide



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Questions

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- 1. What type of value refers to benefits obtained indirectly from ecosystems?**
 - A. Existence value**
 - B. Ethical value**
 - C. Indirect value**
 - D. Ecological value**
- 2. Which factor significantly impacts biomass accumulation in tropical rainforests?**
 - A. Temperature**
 - B. Sunlight penetration**
 - C. Soil moisture**
 - D. Wind patterns**
- 3. What characterizes micronutrients?**
 - A. Nutrients essential for plant growth in large quantities**
 - B. Nutrients typically in small quantities, usually not limiting**
 - C. Nutrients that dominate the nutrient composition of soil**
 - D. Nutrients that cause soil acidification**
- 4. What defines a species in biological terms?**
 - A. A group of organisms that interbreed and produce fertile offspring**
 - B. A collection of similar geographic locations**
 - C. A grouping of organisms based solely on physical traits**
 - D. A set of organisms that inhabit the same ecological niche**
- 5. What type of farming generally targets profit maximization per area cultivated?**
 - A. Cash cropping**
 - B. Mixed farming**
 - C. Pasture farming**
 - D. Commercial farming**

- 6. Which of the following factors is involved in natural selection?**
- A. Random mutation without any environmental impact**
 - B. Competition for resources among individuals**
 - C. Equal reproductive success of all population members**
 - D. Absence of environmental pressures**
- 7. What is meant by the term "carrying capacity"?**
- A. The minimum number of species needed for a stable ecosystem**
 - B. The maximum number of individuals supported by an ecosystem**
 - C. The total biomass an ecosystem can produce**
 - D. The range of species diversity in an ecosystem**
- 8. What does entropy measure in a system?**
- A. The amount of energy available**
 - B. The level of disorder or chaos**
 - C. The efficiency of energy use**
 - D. The total amount of energy**
- 9. What is the sustainable yield?**
- A. The maximum limit of population growth**
 - B. The rate of resource extraction without depletion**
 - C. The total amount of capital available**
 - D. The sum of renewable and non-renewable resources**
- 10. What is the composition of soil?**
- A. A mixture of only organic materials**
 - B. A mixture of mineral particles and organic material**
 - C. Only mineral particles with no organic matter**
 - D. A solely inorganic substance**

Answers

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1. C
2. B
3. B
4. A
5. D
6. B
7. B
8. B
9. B
10. B

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Explanations

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1. What type of value refers to benefits obtained indirectly from ecosystems?

- A. Existence value**
- B. Ethical value**
- C. Indirect value**
- D. Ecological value**

The correct answer is related to a specific category of ecosystem services that are not directly harvested or consumed but still provide significant benefits to humans and the environment. Indirect value includes the various benefits that ecosystems deliver through processes such as nutrient cycling, water filtration, and climate regulation. For instance, forests help mitigate climate change by sequestering carbon dioxide and regulating temperature, while wetlands can filter pollutants from water, thus maintaining water quality. These services are essential for supporting life and human activities but are typically not quantified in monetary terms since they do not result in immediate products like timber or fish. Recognizing and valuing these indirect benefits is crucial for effective environmental management and conservation efforts since they highlight the importance of maintaining ecosystem health for sustained human well-being. In contrast, existence value refers to the inherent worth of an ecosystem, regardless of its utility to humans, while ethical value focuses on moral principles that underscore the conservation of nature. Ecological value often emphasizes the functional role of ecosystems within natural processes rather than the benefits derived from them. Therefore, the concept of indirect value correctly captures the essence of those benefits gained from ecosystems that do not involve direct use.

2. Which factor significantly impacts biomass accumulation in tropical rainforests?

- A. Temperature**
- B. Sunlight penetration**
- C. Soil moisture**
- D. Wind patterns**

Biomass accumulation in tropical rainforests is primarily influenced by sunlight penetration. Tropical rainforests are dense ecosystems characterized by a multilayered canopy structure. The upper canopy receives the most direct sunlight, while lower layers receive varying amounts of light, often limited due to shading from the upper canopy. This variation in light availability affects the photosynthetic capacity of the plants, which directly correlates with their growth rates and overall biomass accumulation. Given that photosynthesis is essential for plant growth, areas within the forest that receive more sunlight will generally have higher productivity and biomass accumulation. Conversely, areas that are shaded will have less effective photosynthesis, leading to reduced growth. Consequently, in the context of biomass accumulation, the ability of plants to capture sunlight is a critical factor. While temperature, soil moisture, and wind patterns are also important in different ecosystems, they play a lesser role in the dense canopy of tropical rainforests where sunlight penetration is the primary driver of biomass growth.

3. What characterizes micronutrients?

- A. Nutrients essential for plant growth in large quantities
- B. Nutrients typically in small quantities, usually not limiting**
- C. Nutrients that dominate the nutrient composition of soil
- D. Nutrients that cause soil acidification

Micronutrients are characterized by their requirement in small quantities for various physiological functions in living organisms, particularly plants. They play crucial roles in processes such as enzyme functioning, photosynthesis, and the synthesis of plant hormones. Unlike macronutrients, which are needed in larger amounts (like nitrogen, phosphorus, and potassium), micronutrients such as iron, zinc, copper, and manganese are only required in trace amounts, but they are essential for the overall health and growth of plants. The statement that micronutrients are typically present in small quantities and usually not limiting reflects their unique role in plant nutrition. While they are vital, their concentrations in soil might not be enough to limit plant growth directly unless there is a specific deficiency. When these nutrients are deficient, however, they can significantly impact plant health, indicating their importance despite the small amounts needed. In contrast, the other options incorrectly describe the nature or role of micronutrients. They do not entail being essential in large quantities, dominating soil composition, or causing soil acidification, as those aspects align more closely with other nutrient types or effects. This clarifies their specific and limited usage in the context of plant growth and soil health.

4. What defines a species in biological terms?

- A. A group of organisms that interbreed and produce fertile offspring**
- B. A collection of similar geographic locations
- C. A grouping of organisms based solely on physical traits
- D. A set of organisms that inhabit the same ecological niche

The definition of a species in biological terms is primarily based on the ability of a group of organisms to interbreed and produce fertile offspring. This concept is known as the Biological Species Concept. When members of the same species mate, their offspring are usually capable of reproducing as well, thus maintaining the continuity of the species. This reproductive capability highlights important aspects of species, such as genetic compatibility and the sharing of a common gene pool. The underlying idea is that species are populations that can breed together and are reproductively isolated from other populations. This isolation helps maintain distinct species over time, preventing interbreeding with different species, which might lead to hybridization and potentially sterile offspring. The other choices fail to capture the essence of what defines a species. Geographic locations do not intrinsically define a species; similar regions may host different species. Physical traits are insufficient for defining species because they can be misleading due to convergent evolution or significant variation within a species. Lastly, defining species solely based on ecological niches overlooks the critical role of reproduction and genetic factors that unite members within a species, thus neglecting the biological basis of what constitutes a species.

5. What type of farming generally targets profit maximization per area cultivated?

- A. Cash cropping**
- B. Mixed farming**
- C. Posting farming**
- D. Commercial farming**

The focus of commercial farming is on profit maximization per area cultivated, making it the correct answer. This type of farming is characterized by the large-scale production of crops and livestock for sale in the market, with the primary goal being to generate income rather than to meet subsistence needs. Farmers engaged in commercial farming often employ advanced technologies, fertilizers, and irrigation techniques to enhance productivity and efficiency, allowing them to maximize the yield and ultimately the profit from each cultivated area. Cash cropping is also aimed at profit, but it specifically refers to the cultivation of crops that are grown for direct sale in the market rather than for personal use or livestock feed. While it can be profit-focused, it does not encompass all aspects of commercial farming, which can include livestock and other agricultural products. Mixed farming involves both crop cultivation and livestock raising, providing some degree of income stability and risk management but is less focused solely on maximizing profits from a per-area perspective than pure commercial farming. Posting farming appears to be an incorrect term in this context, as it does not align with established agricultural practices or terminology. In summary, commercial farming embodies the principles of profit maximization through optimized production practices, making it the most accurate choice among the options provided.

6. Which of the following factors is involved in natural selection?

- A. Random mutation without any environmental impact**
- B. Competition for resources among individuals**
- C. Equal reproductive success of all population members**
- D. Absence of environmental pressures**

Natural selection is a fundamental mechanism of evolution characterized by the differential survival and reproduction of individuals based on their traits which are influenced by environmental pressures. The critical factor in this process is the competition for resources among individuals in a population. When resources such as food, water, or mates are scarce, individuals with advantageous adaptations are more likely to survive and reproduce, thereby passing these beneficial traits to their offspring. This competitive interaction drives natural selection by favoring individuals that are better suited to their environment, which leads to evolutionary changes in the population over time. In contrast, the other factors listed do not contribute to the process of natural selection: random mutations may introduce genetic variation, but they are not influenced by environmental pressures, equal reproductive success means no advantage for particular traits, and the absence of environmental pressures negates the selection process altogether. Therefore, competition for resources is essential for natural selection to occur, making it the key factor in this evolutionary mechanism.

7. What is meant by the term "carrying capacity"?

- A. The minimum number of species needed for a stable ecosystem**
- B. The maximum number of individuals supported by an ecosystem**
- C. The total biomass an ecosystem can produce**
- D. The range of species diversity in an ecosystem**

The term "carrying capacity" refers to the maximum number of individuals of a particular species that an ecosystem can sustainably support over time, given the available resources such as food, water, habitat, and other necessities. This concept is crucial in understanding population dynamics and ecological balance. When a population exceeds its carrying capacity, it may lead to resource depletion, increased competition, and ultimately a decline in population numbers or ecosystem health. Each ecosystem has its own unique carrying capacity influenced by various factors, including the availability of resources, environmental conditions, and interactions with other species. Understanding carrying capacity helps in the management of wildlife populations and the conservation of ecosystems, ensuring that species thrive within their natural limits without causing degradation to their habitat or other species.

8. What does entropy measure in a system?

- A. The amount of energy available**
- B. The level of disorder or chaos**
- C. The efficiency of energy use**
- D. The total amount of energy**

Entropy is a fundamental concept in thermodynamics and physical sciences, representing the degree of disorder or randomness in a system. In essence, a system with high entropy is characterized by a greater amount of disorder, indicating that its energy is distributed in a less organized manner. When a system undergoes change, such as energy transformations, the concept of entropy helps to understand whether these processes are spontaneous and how they proceed. Natural processes tend to move toward states of higher entropy, reflecting the tendency of systems to evolve toward greater disorder over time. This understanding of entropy is crucial in discussions of efficiency and energy use. While options that mention energy availability, efficiency, or total energy can relate to entropy, they do not directly capture its essence. Entropy fundamentally serves as a metric for disorder, distinguishing it as the correct choice in this context.

9. What is the sustainable yield?

- A. The maximum limit of population growth
- B. The rate of resource extraction without depletion**
- C. The total amount of capital available
- D. The sum of renewable and non-renewable resources

Sustainable yield refers specifically to the rate at which a renewable resource can be harvested without compromising its future availability. This concept is particularly important in the context of environmental management and natural resource utilization. It implies a balance where the amount extracted does not exceed what can naturally regenerate over a specified period. By focusing on the rate of resource extraction without depletion, the notion of sustainable yield emphasizes the importance of responsible management practices that allow for continued availability of resources for future generations. This can apply to various resources, including forests, fisheries, or water supplies, where maintaining the ecosystem's health is crucial. The other options do not capture the essence of sustainable yield. For instance, the maximum limit of population growth pertains more to biological carrying capacity than resource use. The total amount of capital available relates to economics rather than the sustainable management of resources. The sum of renewable and non-renewable resources does not indicate how these resources should be extracted or used sustainably. Thus, the focus on extraction rates without depleting the resource makes the correct option the most relevant and precise definition of sustainable yield.

10. What is the composition of soil?

- A. A mixture of only organic materials
- B. A mixture of mineral particles and organic material**
- C. Only mineral particles with no organic matter
- D. A solely inorganic substance

Soil is a complex and dynamic ecosystem that is composed of various materials. The correct answer highlights that soil consists of a mixture of mineral particles and organic material. This composition is essential because mineral particles, derived from the weathering of rocks, provide structure and nutrients to support plant growth. Organic materials, which include decomposed plant and animal matter, contribute to the fertility of the soil by enhancing nutrient availability and improving soil structure. The combination of these two components creates a habitat for a diverse array of organisms, including bacteria, fungi, insects, and earthworms, all of which play a critical role in nutrient cycling and soil health. Together, minerals and organic content make soil a vital resource for ecosystems and agriculture. In contrast, the incorrect options suggest compositions that are either exclusively organic or inorganic. These alternatives fail to recognize the crucial relationship between mineral and organic components that characterizes healthy soil. Understanding soil's mixed composition is foundational for studying environmental systems, agriculture, and ecology.