Arizona State University (ASU) BIO182 General Biology II Exam 2 Practice (Sample)

Study Guide

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Questions

1. What does genotype frequency provide information about in a population?

   A. The total number of organisms

   B. The relative number of each genotype

   C. The overall health of the population

   D. The diversity of alleles present

2. Which reproductive isolation occurs when the mating schedules of species do not align?

   A. Mechanical isolation

   B. Temporal isolation

   C. Behavioral isolation

   D. Genetic isolation

3. What is defined as a homologous trait shared by some but not all members of a group?

   A. Plesiomorphy

   B. Synamorphy

   C. Taxa

   D. Ancestral trait

4. Which factors are crucial for influencing population growth?

   A. Only birth rates and immigration

   B. Birth rates, death rates, immigration, emigration, and environmental resources

   C. Birth rates and environmental pollution

   D. Only the availability of resources

5. What does "fitness" refer to in a biological context?

   A. The average number of offspring produced by an individual

   B. The strength of an allele

   C. The ability to survive

   D. The success of a genotype across generations

6. In a population, individuals not choosing mates based on particular heritable characteristics is indicative of?

A. Nonrandom mating

B. Random mating

C. Positive assortative mating

D. Negative assortative mating

7. Which of the following are the phases of mitosis?

A. Interphase, prophase, anaphase, telophase

B. Prophase, metaphase, anaphase, telophase

C. Prophase, cytokinesis, metaphase, anaphase

D. Metaphase, anaphase, telophase, interphase

8. What does heterozygosity indicate about a population?

A. Number of homozygous individuals

B. Frequency of recessive alleles

C. Probability of different alleles being chosen from the population

D. Overall fitness of the population

9. Which evolutionary mechanism can help drive sympatric speciation through sexual selection?

A. Disruptive selection

B. Natural selection

C. Directional selection

D. Stabilizing selection

10. Which of the following best describes the term "gene flow"?

A. The exchange of genes between populations

B. The introduction of mutations in a population

C. The selection of traits that promote survival

D. The adaptation of organisms to their environment

Answers

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

Explanations

1. What does genotype frequency provide information about in a population?

A. The total number of organisms

B. The relative number of each genotype

C. The overall health of the population

D. The diversity of alleles present

Genotype frequency provides information about the relative number of each genotype present in a population. It specifically measures how common or rare certain genetic makeups are compared to others within a defined group of organisms. By analyzing genotype frequencies, researchers can understand the genetic structure of a population, assess how traits may be inherited, and even investigate evolutionary processes. This data can shed light on patterns such as selective pressures, mating strategies, and potential adaptations within the population. It does not directly indicate the total number of organisms, the overall health of the population, or the diversity of alleles present; rather, it focuses specifically on the distribution of genotypes.

2. Which reproductive isolation occurs when the mating schedules of species do not align?

A. Mechanical isolation

B. Temporal isolation

C. Behavioral isolation

D. Genetic isolation

Temporal isolation is a form of reproductive isolation that occurs when different species breed at different times, which prevents them from mating even if they live in the same area. This could manifest in different mating behaviors, seasonal breeding, or even differences in circadian rhythms that affect when species are active. For example, one species may reproduce in the spring while another species reproduces in the fall, thus reinforcing their separation despite potential overlapping habitats. This form of isolation is crucial in preventing gene flow between populations, allowing them to evolve independently over time. It helps maintain the distinct characteristics of each species, which is essential for the process of speciation.

3. What is defined as a homologous trait shared by some but not all members of a group?

A. Plesiomorphy

B. Synamorphy

C. Taxa

D. Ancestral trait

The correct answer refers to a synapomorphy, which is defined as a derived character or trait that is shared by some, but not all, members of a specific group or clade. This term is particularly important in the context of phylogenetics, where synapomorphies are used to help establish the evolutionary relationships among organisms. By identifying these shared derived traits, researchers can determine which species are more closely related to each other based on their common ancestry. In contrast, a plesiomorphy refers to an ancestral trait that is retained from a common ancestor and is not necessarily a defining characteristic of a derived group. A taxa, on the other hand, denotes a taxonomic group itself rather than a trait, and an ancestral trait indicates traits present in an ancestor that may not be useful for defining groups derived from that ancestor. Thus, the focus on derived traits that signify a specific lineage makes synapomorphy a key concept for understanding evolutionary relationships.

4. Which factors are crucial for influencing population growth?

A. Only birth rates and immigration

B. Birth rates, death rates, immigration, emigration, and environmental resources

C. Birth rates and environmental pollution

D. Only the availability of resources

The correct answer encompasses a broad range of factors that influence population growth, highlighting the complexity of how populations change over time. Birth rates are essential because they determine how many individuals are added to a population through reproduction. Death rates play a critical role by accounting for the loss of individuals, which can dramatically influence overall population size. Immigration and emigration also significantly affect population dynamics. Immigration refers to the influx of individuals into a population, thereby increasing its size, while emigration represents individuals leaving the population, leading to a potential decrease in size. Together, these two factors can cause populations to grow or shrink based on the balance between them. Environmental resources are equally important, as they dictate the carrying capacity of an area. The availability of food, water, and shelter influences the survival and reproduction rates of a population. When resources are abundant, populations can thrive; conversely, limited resources can lead to increased competition, higher death rates, and lower birth rates. Therefore, considering all these components provides a comprehensive understanding of the mechanisms driving population growth and change.

5. What does "fitness" refer to in a biological context?

A. The average number of offspring produced by an individual

B. The strength of an allele

C. The ability to survive

D. The success of a genotype across generations

In a biological context, "fitness" primarily refers to the success of a genotype across generations. This concept encompasses not just the ability to survive but also the overall contribution of an individual's genotype to the gene pool of the next generation. Fitness is most often measured in terms of reproductive success – specifically, the average number of offspring produced by an individual that survive and reproduce themselves. This means that fitness extends beyond mere survival, as it emphasizes the importance of reproduction. An individual that might live long yet produces few or no offspring would not be considered as 'fit' as another individual that may have a shorter lifespan but produces many offspring that live to reproduce. While the number of offspring is a critical component of fitness, it is essential to note that this is just one aspect of a broader definition that includes genetic contribution and success across generations. Understanding fitness in this way allows us to appreciate the mechanisms of natural selection and evolutionary theory more fully.

6. In a population, individuals not choosing mates based on particular heritable characteristics is indicative of?

A. Nonrandom mating

B. Random mating

C. Positive assortative mating

D. Negative assortative mating

In a population, individuals not choosing mates based on particular heritable characteristics signifies random mating. This concept refers to a situation where mate selection occurs without any bias towards specific traits or characteristics. In random mating, all individuals have an equal chance of mating regardless of their genetic or phenotypic traits. This principle is crucial in population genetics because random mating allows for the mixing of alleles, maintaining genetic variation within a population. When mating is random, the distribution of genotypes remains stable over generations, assuming no other evolutionary forces are at play. The other options pertain to forms of nonrandom mating, where mate selection is influenced by specific heritable traits. Positive assortative mating occurs when individuals with similar traits choose each other, while negative assortative mating happens when individuals with dissimilar traits prefer to mate with one another. These forms affect allele frequencies differently and can lead to distinct evolutionary outcomes in a population. Therefore, the absence of preferential mate choice indicates a scenario of random mating, where individuals pair without regard to their heritable characteristics.

7. Which of the following are the phases of mitosis?

A. Interphase, prophase, anaphase, telophase

B. Prophase, metaphase, anaphase, telophase

C. Prophase, cytokinesis, metaphase, anaphase

D. Metaphase, anaphase, telophase, interphase

Mitosis is the process of cell division that results in two genetically identical daughter cells. It consists of clearly defined phases that each play a crucial role in the proper segregation of chromosomes. The correct choice includes prophase, metaphase, anaphase, and telophase, which are the key stages in the mitotic process. In prophase, chromosomes condense and become visible, the nuclear envelope begins to break down, and spindle fibers start forming. Metaphase follows, wherein chromosomes align at the cell's equatorial plane, ensuring that each sister chromatid is positioned for separation. During anaphase, the sister chromatids are pulled apart by the spindle fibers towards opposite poles of the cell. Finally, in telophase, the separated chromosomes reach the poles, decondense back to chromatin, and the nuclear envelope re-forms around each set of chromosomes. These phases are critical for ensuring each daughter cell receives the correct number of chromosomes, and understanding them is fundamental to the study of cell biology and organism development.

8. What does heterozygosity indicate about a population?

A. Number of homozygous individuals

B. Frequency of recessive alleles

C. Probability of different alleles being chosen from the population

D. Overall fitness of the population

Heterozygosity refers to the presence of different alleles at a gene locus within an individual or a population. When this term is applied to a population, it indicates the genetic diversity present in that population. High heterozygosity suggests that there are many different alleles for a given gene among the individuals, which increases the probability of selecting different alleles from that population during reproduction. This genetic variability is crucial for the adaptability and resilience of a population, allowing it to respond more effectively to environmental changes or diseases. Therefore, by assessing heterozygosity, researchers can gauge the likelihood of different alleles being present and passed on to the next generation, contributing to the genetic richness of the population. This understanding plays a significant role in conservation biology, as populations with low heterozygosity may be more vulnerable to extinction due to their reduced ability to adapt to changes.

9. Which evolutionary mechanism can help drive sympatric speciation through sexual selection?

A. Disruptive selection

B. Natural selection

C. Directional selection

D. Stabilizing selection

Disruptive selection is the correct mechanism that can drive sympatric speciation through sexual selection. This type of selection occurs when extreme traits that diverge from the average phenotype are favored over intermediate traits in a population. In the context of sexual selection, individuals with extreme traits might attract mates more successfully than those with average traits. As a result, this preferential mating can enhance reproductive isolation within a population, as individuals start to mate based on these extreme traits rather than the average phenotype, leading to the formation of distinct subpopulations. Over time, this can culminate in the emergence of new species without a geographic barrier, as the two subpopulations may evolve independently due to their preference for different mating choices. The other mechanisms listed do not specifically facilitate sympatric speciation through sexual selection in the same way. Natural selection, directional selection, and stabilizing selection tend not to create the types of reproductive isolation needed for sympatric speciation. Instead, they often result in populations that are more homogeneous or shift towards a single advantageous trait rather than promoting divergence among subpopulations.

10. Which of the following best describes the term "gene flow"?

A. The exchange of genes between populations

B. The introduction of mutations in a population

C. The selection of traits that promote survival

D. The adaptation of organisms to their environment

The term "gene flow" refers specifically to the movement of genes between populations, which occurs when individuals from one population migrate to another and breed. This exchange can introduce new genetic material into a population, impacting genetic diversity and potentially altering evolutionary trajectories. Gene flow is a critical mechanism in evolution, as it can counteract the effects of genetic drift and natural selection by promoting genetic variation among populations. The other choices describe distinct biological concepts. The introduction of mutations refers to changes in the DNA sequence that can create new alleles, while the selection of traits that promote survival pertains to natural selection, where certain traits become more common in a population due to their advantages in a given environment. Adaptation focuses on how organisms change in response to environmental pressures over time, but it does not encapsulate the idea of gene movement between populations like gene flow does. Therefore, the definition provided by the correct choice accurately emphasizes the importance of interpopulation genetic exchange.