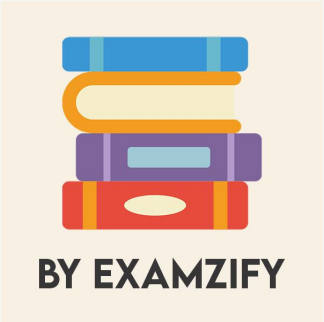
# University of Central Florida (UCF) BSC1005 Biological Principles Practice Exam 2 (Sample)

Study Guide

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# Questions

1. What separates during anaphase I of meiosis?

   A. Sister chromatids

   B. Diploid cells

   C. Homologous chromosomes

   D. Haploid gametes

2. Why is genetic variability significant in sexual reproduction?

   A. It leads to more genetically uniform populations

   B. It reduces the energy required for reproduction

   C. It increases the chances of adaptation to changing environments

   D. It eliminates the need to find a mate

3. Which type of speciation occurs due to geographic barriers leading to reproductive isolation?

   A. Sympatric Speciation

   B. Parapatric Speciation

   C. Allopatric Speciation

   D. Polyploid Speciation

4. What is the role of ribosomes in the cell?

   A. To synthesize lipids

   B. To produce ATP

   C. To synthesize proteins

   D. To digest cellular waste

5. Which scenario exemplifies global extinction?

   A. Human disruption of an ecosystem

   B. Loss of a species from one area while remaining elsewhere

   C. Complete loss of species such as dinosaurs or the Javan tiger

   D. Temporary decline in population size

6. Which macromolecule is primarily responsible for energy storage in organisms?

A. Proteins

B. Lipids

C. Nucleic acids

D. Carbohydrates

7. What occurs during anaphase of mitosis?

A. Sister chromatids separate

B. Chromosomes align at the center

C. Nucleus disintegrates

D. Chromosomes condense

8. What holds the two strands of DNA together?

A. Covalent bonds between sugar and phosphate groups

B. Ionic bonds between nitrogenous bases

C. Hydrogen bonds between complementary nitrogenous bases

D. Van der Waals forces between nucleotides

9. What is a karyotype?

A. A visual representation of an individual's chromosomes

B. A measurement of gene expression levels

C. A type of DNA mutation

D. A process of cellular respiration

10. What is the primary purpose of meiosis?

A. To create identical cells for growth

B. To produce gametes with half the number of chromosomes

C. To enable cell repair

D. To duplicate the genome

# Answers

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

# Explanations

1. What separates during anaphase I of meiosis?

A. Sister chromatids

B. Diploid cells

C. Homologous chromosomes

D. Haploid gametes

During anaphase I of meiosis, homologous chromosomes are the structures that separate and move to opposite poles of the cell. This process is critical for reducing the chromosome number in the resulting gametes, ensuring that each gamete receives only one chromosome from each homologous pair. In meiosis, the first division is designed to separate these homologous chromosomes, which each consist of two sister chromatids, but it is important to note that the sister chromatids do not separate until anaphase II. Thus, the focus during anaphase I is specifically on the separation of homologous chromosomes. The term "diploid cells" refers to the entire cell at the beginning of meiosis before any divisions occur, while "haploid gametes" refers to the end products of meiosis after both divisions have been completed. Hence, these terms don't accurately describe what happens during anaphase I. The distinction is crucial in understanding the mechanics of meiosis and its role in sexual reproduction.

2. Why is genetic variability significant in sexual reproduction?

A. It leads to more genetically uniform populations

B. It reduces the energy required for reproduction

C. It increases the chances of adaptation to changing environments

D. It eliminates the need to find a mate

Genetic variability is a cornerstone of sexual reproduction, primarily because it enhances the adaptability of a population. When organisms reproduce sexually, the combination of genetic material from two parents leads to offspring with unique genetic profiles. This variability is significant for several reasons. One of the most critical advantages of having a genetically diverse population is the increased chances of surviving and thriving in changing environments. Diverse genetic traits mean that within a population, some individuals may possess characteristics that enable them to withstand environmental stresses, such as disease, climate variations, or shifts in food availability. These adaptations can lead to improved survival and reproductive success, allowing the population to persist over generations. Additionally, genetic variability facilitates evolution through natural selection. If a particular environmental challenge arises, the presence of varied genetic traits means that the likelihood of some individuals being better suited to the new conditions increases, thereby contributing to the evolution of the species over time. In contrast, more genetically uniform populations may struggle to adapt because if a trait that is vital for survival in a specific environment is absent, the entire population could be at risk. Thus, genetic variability plays a crucial role in the resilience and long-term survival of species by promoting adaptation and evolution.

3. Which type of speciation occurs due to geographic barriers leading to reproductive isolation?

A. Sympatric Speciation

B. Parapatric Speciation

C. Allopatric Speciation

D. Polyploid Speciation

The correct answer is Allopatric Speciation, which occurs when a population is divided by geographic barriers such as mountains, rivers, or distance, leading to reproductive isolation. When populations become geographically separated, they can no longer interbreed, and over time, the isolated populations may undergo genetic changes due to natural selection, genetic drift, or mutation. These changes can lead to the development of distinct species, as the separated populations adapt to their unique environments and evolutionary pressures. This process is fundamental in understanding how species evolve and diversify, as geographic isolation creates opportunities for different evolutionary paths. As a result, the populations may develop different characteristics and reproductive mechanisms, solidifying their status as separate species despite their common ancestry.

4. What is the role of ribosomes in the cell?

A. To synthesize lipids

B. To produce ATP

C. To synthesize proteins

D. To digest cellular waste

Ribosomes play a crucial role in the process of protein synthesis, which is essential for various cellular functions and the overall metabolism of the cell. They are the molecular machines responsible for translating messenger RNA (mRNA) sequences into polypeptide chains, which ultimately fold into functional proteins. This function is vital because proteins are necessary for virtually all cellular processes, including structural support, enzymatic activities, and regulatory functions. Ribosomes can be found both free in the cytoplasm and attached to the endoplasmic reticulum, contributing to the production of proteins that are either secreted from the cell or incorporated into cellular membranes. The accurate and efficient synthesis of proteins by ribosomes is a fundamental aspect of cellular biology and is essential for the growth, repair, and maintenance of all living organisms.

5. Which scenario exemplifies global extinction?

A. Human disruption of an ecosystem

B. Loss of a species from one area while remaining elsewhere

C. Complete loss of species such as dinosaurs or the Javan tiger

D. Temporary decline in population size

The scenario of complete loss of a species, such as dinosaurs or the Javan tiger, exemplifies global extinction because it signifies that the species has entirely vanished from the Earth and can no longer be found anywhere in any habitat. When a species goes extinct, it means that all individuals of that species have died out, eliminating their presence from biodiversity entirely. This concept of global extinction underlines the importance of species conservation, as once a species is extinct, it cannot be brought back, and the ecological roles it played are lost permanently. For instance, dinosaurs represent a significant extinction event that has had profound implications for the evolution and development of life on Earth. The Javan tiger, similarly, serves as an example of how human activities can lead to the complete disappearance of a species, emphasizing the stakes involved in biodiversity preservation. In contrast, options discussing human disruption of an ecosystem or a temporary decline in population size do not constitute global extinction since they suggest the possibility of recovery or persistence of species in other areas. Additionally, the loss of a species from one area while remaining elsewhere indicates that the species is not globally extinct, as it continues to exist in certain locations.

6. Which macromolecule is primarily responsible for energy storage in organisms?

A. Proteins

B. Lipids

C. Nucleic acids

D. Carbohydrates

Lipids are primarily responsible for energy storage in organisms due to their unique structure and properties. They have long hydrocarbon chains that can store a significant amount of energy, which is released when these molecules are broken down through metabolic processes. Unlike carbohydrates, which are quickly utilized for energy and serve more for immediate energy needs, lipids provide a dense form of energy storage that can be tapped into over a longer period. This is particularly important for organisms that require energy reserves for times of scarcity, such as during periods of fasting or increased energy demand. Lipids, including triglycerides, are stored in adipose (fat) tissue in animals, serving both as an energy reserve and a means of insulation and protection for vital organs. This makes lipids a crucial macromolecule for energy storage compared to proteins, nucleic acids, and carbohydrates, which play different roles in the body, such as structural support, genetic information storage, and immediate energy supply, respectively.

7. What occurs during anaphase of mitosis?

A. Sister chromatids separate

B. Chromosomes align at the center

C. Nucleus disintegrates

D. Chromosomes condense

During anaphase of mitosis, sister chromatids separate and move toward opposite poles of the cell. This separation is crucial for ensuring that each daughter cell receives an identical set of chromosomes following cell division. The process begins when the centromere that holds the sister chromatids together splits, allowing the spindle fibers to pull each chromatid to opposite ends of the cell. This action is vital for maintaining the correct number of chromosomes in the resulting daughter cells, which is essential for proper cell function and genetic stability. The other processes mentioned in the options occur at different stages of mitosis. For instance, chromosome alignment at the center happens during metaphase, while the disintegration of the nucleus is observed during prophase, and condensation of chromosomes occurs early in the prophase stage as the chromatin becomes more compact.

8. What holds the two strands of DNA together?

A. Covalent bonds between sugar and phosphate groups

B. Ionic bonds between nitrogenous bases

C. Hydrogen bonds between complementary nitrogenous bases

D. Van der Waals forces between nucleotides

The two strands of DNA are held together by hydrogen bonds between complementary nitrogenous bases. Each DNA strand consists of a sequence of nucleotides, and each nucleotide contains a nitrogenous base (adenine, thymine, cytosine, or guanine). In a DNA double helix, adenine on one strand pairs with thymine on the opposite strand through two hydrogen bonds, while cytosine pairs with guanine through three hydrogen bonds. This specific pairing is crucial for the stability of the DNA molecule and ensures accurate replication during cell division. The hydrogen bonds, while individually weak, collectively provide significant stability to the structure, allowing the DNA helix to maintain its integrity while also being flexible enough to unwind during replication and transcription processes. This characteristic is essential for the functioning of DNA in genetic coding and expression.

9. What is a karyotype?

A. A visual representation of an individual's chromosomes

B. A measurement of gene expression levels

C. A type of DNA mutation

D. A process of cellular respiration

A karyotype is a visual representation of an individual's chromosomes arranged in a standard format. This arrangement typically includes all the chromosomes in pairs, organized by size and shape, allowing for the analysis of their number and structure. Karyotyping is a crucial tool in genetics, as it helps identify chromosomal abnormalities such as aneuploidies (like Down syndrome, which results from the presence of an extra chromosome 21), structural changes, and other genetic disorders. It serves as a foundational technique in medical genetics, prenatal diagnosis, and cancer research, making it essential for understanding chromosomal characteristics and their implications for health. In contrast, measurements of gene expression levels pertain to the amount of mRNA produced by genes and do not directly relate to the organization of chromosomes. DNA mutations refer to changes in the sequence of the nucleotides in DNA, and cellular respiration involves biochemical processes that convert nutrients into energy, neither of which pertains to the structure or visualization of chromosomes.

10. What is the primary purpose of meiosis?

A. To create identical cells for growth

B. To produce gametes with half the number of chromosomes

C. To enable cell repair

D. To duplicate the genome

The primary purpose of meiosis is indeed to produce gametes with half the number of chromosomes. Meiosis is a specialized type of cell division that occurs in sexually reproducing organisms and is crucial for sexual reproduction. Through the process of meiosis, a diploid cell (containing two sets of chromosomes) undergoes two rounds of division to generate four haploid gametes (sperm and egg cells in animals) that contain only one set of chromosomes. This reduction in chromosome number is essential for maintaining the stability of an organism's chromosome number across generations during fertilization, where two haploid gametes fuse to form a diploid zygote. This mechanism ensures genetic diversity through processes such as independent assortment and crossing over during meiosis, which contribute to the variation seen in offspring. The other options do not correctly reflect the fundamental role of meiosis; for instance, creating identical cells for growth pertains to mitosis, while cell repair mechanisms typically involve different cellular processes not related to meiosis. Duplicating the genome refers more to the replication of DNA prior to cell division rather than the purpose of meiosis itself.