Lithuanian University of Health Sciences (LSMU) Entrance Practice exam (Sample)

Study Guide

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Questions

1. What is a characteristic of asexual reproduction?

A. Requires two organisms

B. Produces genetically diverse offspring

C. Involves one organism making a copy of itself

D. Involves fertilization between gametes

2. In which tissue type is there a higher concentration of collagen fibers and less dense tissue?

A. Loose connective tissue

B. Dense connective tissue

C. Reticular connective tissue

D. Elastic connective tissue

3. What type of muscle is classified as involuntary and non-striated?

A. Skeletal muscle

B. Cardiac muscle

C. Smooth muscle

D. Striated muscle

4. During which process does a substance undergo a phase change from solid to liquid?

A. Melting

B. Freezing

C. Sublimation

D. Condensation

5. What is the main function of thyroid hormone (T3/T4)?

A. Stimulates insulin production

B. Regulates basic metabolic rate

C. Increases milk production

D. Suppresses immune responses

6. What is the formula for hydrogen phosphate?

A. NH4+

B. HPO4 2-

C. HSO4-

D. SO3 2-

7. What are the primary functions of the G1 and G2 phases of the cell cycle?

A. Chromatid separation

B. Preparatory phases for mitosis

C. Excess cell growth and DNA breakdown

D. Formation of a cleavage furrow

8. What is the role of antibodies produced by B lymphocytes?

A. To transport oxygen in the blood

B. To facilitate cellular respiration

C. To fight bacterial infections

D. To regulate blood clotting

9. Which nitrogen bases pair together in DNA?

A. Adenine with Cytosine, Thymine with Guanine

B. Adenine with Thymine, Guanine with Cytosine

C. Thymine with Cytosine, Adenine with Guanine

D. Adenine with Uracil, Guanine with Thymine

10. What is a primary characteristic of tight junctions?

A. Facilitate cell communication

B. Form a barrier between adjacent cells

C. Encourage cell growth

D. Support nerve signal transmission

Answers

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

Explanations

1. What is a characteristic of asexual reproduction?

A. Requires two organisms

B. Produces genetically diverse offspring

C. Involves one organism making a copy of itself

D. Involves fertilization between gametes

Asexual reproduction is characterized by the process where a single organism creates offspring that are genetically identical to itself. This method does not require the involvement of another organism and does not involve the formation or fusion of gametes (sperm and egg cells), which is a hallmark of sexual reproduction. Thus, the correct answer accurately captures the essence of asexual reproduction, emphasizing the role of a single organism in generating clones of itself. This process can occur through various means, such as binary fission, budding, or vegetative propagation, all leading to offspring that retain the genetic material of the parent.

2. In which tissue type is there a higher concentration of collagen fibers and less dense tissue?

A. Loose connective tissue

B. Dense connective tissue

C. Reticular connective tissue

D. Elastic connective tissue

The correct answer highlights the characteristics of dense connective tissue. Dense connective tissue is characterized by a high concentration of collagen fibers, which provide strength and structure. This type of tissue is composed of closely packed collagen fibers arranged in a parallel configuration, making it very robust and supportive, which is essential for areas that require tensile strength, such as ligaments and tendons. The density of collagen fibers in dense connective tissue contrasts with the looser arrangement found in other tissue types, particularly loose connective tissue. Dense connective tissue does not allow for much interstitial space, resulting in a firmer structure. While reticular connective tissue does contain collagen fibers, they are primarily arranged in a network that supports various organs, which is different from the high density and orderly alignment found in dense connective tissue. Elastic connective tissue also features a high proportion of fibers but includes a significant amount of elastin, making it more flexible rather than offering the same tensile strength seen in dense connective tissue. Thus, the emphasis on high collagen fiber concentration and the strength of dense connective tissue directly supports why it is the correct answer.

3. What type of muscle is classified as involuntary and non-striated?

A. Skeletal muscle

B. Cardiac muscle

C. Smooth muscle

D. Striated muscle

Smooth muscle is classified as involuntary and non-striated, which is key to its function and characteristics. Unlike skeletal muscle, which is striated and under voluntary control, smooth muscle operates automatically and is found in various organs, such as the digestive tract, blood vessels, and the uterus. This involuntary nature allows smooth muscle to contract and relax in response to internal body signals and autonomic nervous system regulation without conscious effort. The lack of striations in smooth muscle cells is due to the arrangement of muscle fibers. In contrast, cardiac muscle, while also involuntary, is striated and found only in the heart, with distinct structural and functional characteristics compared to smooth muscle. Skeletal muscle, on the other hand, is striated and under voluntary control, enabling precise movements. Striated muscle is a general term that encompasses both skeletal and cardiac muscle, but does not include smooth muscle. This distinction highlights why smooth muscle is the correct answer to the question.

4. During which process does a substance undergo a phase change from solid to liquid?

A. Melting

B. Freezing

C. Sublimation

D. Condensation

The process in which a substance changes from solid to liquid is known as melting. This occurs when the temperature of the solid increases to its melting point, allowing the particles to gain enough energy to break free from their ordered arrangement in the solid state. As a result, the substance transforms into a liquid, where the particles are still close together but can move more freely. The other processes listed do not describe the transition from solid to liquid. Freezing is the reverse, where a liquid becomes a solid. Sublimation refers to the transition from solid directly to gas without passing through the liquid phase. Condensation describes the process through which gas changes into a liquid. Thus, melting is distinct in that it specifically signifies the transition from a solid to a liquid.

5. What is the main function of thyroid hormone (T3/T4)?

A. Stimulates insulin production

B. Regulates basic metabolic rate

C. Increases milk production

D. Suppresses immune responses

The main function of thyroid hormone, specifically thyroxine (T4) and triiodothyronine (T3), is to regulate the basic metabolic rate of the body. This entails influencing how quickly the body uses energy, generates heat, and consumes oxygen. Thyroid hormones are crucial for the metabolism of carbohydrates, fats, and proteins, thus impacting overall energy expenditure and metabolic processes. The thyroid hormones increase the metabolic rate by promoting the use of glucose and fatty acids for energy, enhancing the action of other hormones, and influencing the development and function of various tissues. This role is vital for maintaining energy balance and overall physiological health, affecting everything from body temperature regulation to growth and development. While insulin production, milk production, and immune response regulation are important physiological processes, they are primarily controlled by other hormones and systems in the body rather than directly by thyroid hormones. For example, insulin is primarily regulated by the pancreas, and milk production is mainly influenced by prolactin. Overall, understanding the specific role of thyroid hormones in metabolism is essential for grasping their significance in maintaining homeostasis within the body.

6. What is the formula for hydrogen phosphate?

A. NH4+

B. HPO4 2-

C. HSO4-

D. SO3 2-

The formula for hydrogen phosphate is represented as HPO4 2-. This compound is a polyatomic ion that has a negative two charge, indicating that it has lost two protons (H+) compared to phosphoric acid (H3PO4). The presence of hydrogen in the formula signifies it is a hydrogen phosphate, distinguishing it from other phosphate species like dihydrogen phosphate (H2PO4-) and phosphate (PO4 3-). Hydrogen phosphate plays an essential role in biological systems, particularly in energy transfer and storage, being a component of ATP (adenosine triphosphate) and an important buffer in biological fluids. Its structure includes a phosphorus atom centrally located and bonded to four oxygen atoms, one of which is also bonded to a hydrogen atom, leading to its designation as hydrogen phosphate. Understanding the correct chemical notation is crucial in chemistry, especially in biochemistry and related fields, where such ions are involved in many metabolic processes.

7. What are the primary functions of the G1 and G2 phases of the cell cycle?

A. Chromatid separation

B. Preparatory phases for mitosis

C. Excess cell growth and DNA breakdown

D. Formation of a cleavage furrow

The G1 and G2 phases of the cell cycle serve as critical preparatory stages that ensure the cell is ready for mitosis. During the G1 phase, the cell grows and synthesizes proteins necessary for DNA replication. It also assesses its environment and internal conditions to determine if it is suitable to proceed with division. Key processes such as organelle duplication and metabolic activity occur in this phase, setting the stage for the subsequent S phase, where DNA replication takes place. In the G2 phase, the cell continues to grow and prepares for mitosis by synthesizing proteins that are crucial for chromosome separation and cell division. It also conducts DNA repair mechanisms, ensuring that the genetic material is intact before the cell divides. This phase ensures that all cellular components are ready for the complex processes of mitosis, keeping the cell cycle regulated and reducing the risk of errors. The other choices do not accurately reflect the roles of the G1 and G2 phases. The separation of chromatids occurs later during mitosis, while excessive cell growth and DNA breakdown are not characteristic of these preparatory phases. Formation of a cleavage furrow is specifically a part of the cytokinesis stage, which follows mitosis. Therefore, the G1 and G2 phases are indeed primarily

8. What is the role of antibodies produced by B lymphocytes?

A. To transport oxygen in the blood

B. To facilitate cellular respiration

C. To fight bacterial infections

D. To regulate blood clotting

Antibodies produced by B lymphocytes play a crucial role in the immune system, particularly in identifying and neutralizing pathogens such as bacteria and viruses. When B lymphocytes encounter a specific antigen, they differentiate into plasma cells that produce antibodies. These antibodies bind to antigens on the surface of invading microbes, marking them for destruction or directly neutralizing their harmful effects. This action is essential for the body's defense against bacterial infections, as it helps prevent further spread of the bacteria and promotes their elimination by other immune cells. The other roles mentioned, such as transporting oxygen, facilitating cellular respiration, and regulating blood clotting, are functions of different biological molecules and processes in the body. Hemoglobin, for example, is responsible for oxygen transport in red blood cells. Enzymes and cellular components are involved in cellular respiration, while various proteins, including clotting factors, play a role in blood clotting mechanisms. Therefore, the specific role of antibodies produced by B lymphocytes is to combat infectious agents, making option C the correct choice.

9. Which nitrogen bases pair together in DNA?

A. Adenine with Cytosine, Thymine with Guanine

B. Adenine with Thymine, Guanine with Cytosine

C. Thymine with Cytosine, Adenine with Guanine

D. Adenine with Uracil, Guanine with Thymine

In DNA, the pairing of nitrogen bases occurs through specific interactions that are crucial for the structure of the DNA double helix and the encoding of genetic information. Adenine pairs exclusively with Thymine, forming two hydrogen bonds between them. This pairing is essential for maintaining the stability of the DNA structure. Similarly, Guanine pairs with Cytosine, which is slightly more complex as it forms three hydrogen bonds. This difference in bonding strength contributes to the overall stability of the DNA molecule. The options that suggest incorrect pairings either swap these pairs or introduce bases not found in DNA, such as Uracil, which is only present in RNA. Therefore, understanding these base pair relationships is fundamental for grasping concepts in genetics and molecular biology, as they illustrate how genetic information is accurately copied and passed to future generations.

10. What is a primary characteristic of tight junctions?

A. Facilitate cell communication

B. Form a barrier between adjacent cells

C. Encourage cell growth

D. Support nerve signal transmission

Tight junctions play a crucial role in maintaining the integrity of epithelial layers by forming a selective barrier between adjacent cells. They are composed of a network of proteins that connect the membranes of neighboring cells together, creating a seal that prevents the passage of materials through the intercellular space. This characteristic is essential for maintaining a distinct environment on either side of the tissue and regulating the movement of ions, small molecules, and water selectively. This barrier function is vital in various tissues, including those in the intestines, blood-brain barrier, and renal tubules, where it helps to protect underlying tissues and ensure proper physiological functions. While cell communication, growth encouragement, and nerve signal transmission are important aspects of cellular interactions, they do not specifically define the role of tight junctions in the context of maintaining selective permeability and structural integrity between cells.