Arizona State University (ASU) BIO181 General Biology I Exam 2 Practice (Sample)

Study Guide

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Questions

1. How does lymph fluid return from the legs to the circulatory system?

   A. A one way valve pushing it up, with the help of muscles contracting around it

   B. Through arteries that pump it directly into the heart

   C. By diffusion into surrounding tissues

   D. Via the bloodstream through veins and capillaries

2. In the lagging strand, from which end is the DNA read?

   A. 5' to 3'

   B. 3' to 5'

   C. Both

   D. Neither

3. What type of molecules are enzymes typically classified as?

   A. Lipids

   B. Carbohydrates

   C. Proteins

   D. Nucleic acids

4. How can two types of protein synthesis in eukaryotic cells be distinguished?

   A. Based on RNA type

   B. Polyribosome types

   C. Type of DNA

   D. Type of amino acids

5. Amino acids that cannot be synthesized by the body and must be obtained from diet are known as what?

   A. Non-essential amino acids

   B. Conditional amino acids

   C. Essential amino acids

   D. Supplemental amino acids

6. In what way is the making of a primary lysosome similar to the enzymes delivered by the pancreas?

A. Both are made by membrane bound polyribosomes

B. Both are activated by pH changes in the stomach

C. Both contain ribosomal RNA

D. Both are stored in vesicles until needed

7. Which organelle is responsible for energy production in eukaryotic cells?

A. Nucleus

B. Mitochondria

C. Endoplasmic reticulum

D. Golgi apparatus

8. Which enzyme is the first to be added during digestion in the mouth?

A. Protease

B. Amylase

C. Pepsin

D. Lipase

9. What is the function of the nuclear envelope?

A. To provide energy to the cell

B. To protect the nucleus and regulate the movement of materials in and out

C. To synthesize ribosomal RNA

D. To facilitate protein synthesis

10. Which strand of DNA is produced more rapidly during replication?

A. Leading strand

B. Lagging strand

C. Replication fork

D. Okazaki strand

Answers

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

Explanations

1. How does lymph fluid return from the legs to the circulatory system?

A. A one way valve pushing it up, with the help of muscles contracting around it

B. Through arteries that pump it directly into the heart

C. By diffusion into surrounding tissues

D. Via the bloodstream through veins and capillaries

Lymph fluid returns from the legs to the circulatory system primarily through a combination of one-way valves and the action of surrounding muscles. The lymphatic system is designed with valves that ensure unidirectional flow of lymph, preventing backflow as it travels upwards toward the thoracic duct, and ultimately enters the circulatory system. When muscles contract during movement, especially in the legs, they exert pressure on nearby lymphatic vessels, helping to push the lymph fluid upwards. This mechanism is crucial for overcoming gravity, particularly when returning fluid from the lower extremities to the upper body. In contrast, the options regarding pumping through arteries and direct diffusion do not accurately reflect the functioning of the lymphatic system. The lymphatic system works independently of blood circulation in arteries and does not involve direct diffusion from interstitial fluids into tissues without a transport mechanism. Additionally, while there may be some contribution from veins, the primary role of the lymphatic system is to transport lymph fluid, which is distinct from blood circulation. Thus, the actions of muscle contraction and the presence of valves are essential components of the lymphatic return mechanism.

2. In the lagging strand, from which end is the DNA read?

A. 5' to 3'

B. 3' to 5'

C. Both

D. Neither

In DNA replication, the lagging strand is synthesized discontinuously in short segments known as Okazaki fragments. This occurs because DNA polymerase can only add nucleotides in a 5' to 3' direction. Therefore, while the overall process of synthesizing the lagging strand happens in the 5' to 3' direction, the DNA template is read from the 3' to 5' direction. To clarify, DNA polymerase moves along the template strand from its 3' end to its 5' end in order to synthesize new DNA, thereby creating a complementary strand that runs in the 5' to 3' orientation. This means that for the lagging strand, the DNA is effectively being read from the 3' to 5' end of the template strand, allowing new nucleotides to be added in the correct direction. This understanding of how the lagging strand is synthesized is vital because it illustrates the asymmetrical nature of DNA replication as well as the unique challenges faced in the replication process. Knowing this fundamental aspect helps in grasping broader concepts in molecular biology, including replication mechanics and enzyme functionality.

3. What type of molecules are enzymes typically classified as?

A. Lipids

B. Carbohydrates

C. Proteins

D. Nucleic acids

Enzymes are typically classified as proteins, which are large, complex molecules made up of long chains of amino acids. Each enzyme has a specific three-dimensional structure that is essential for its function, as the shape of the enzyme determines its ability to bind to specific substrates and facilitate chemical reactions. The active site of an enzyme is specially tailored to fit its substrate, allowing for the effective lowering of activation energy and increasing the rate of biochemical reactions. While lipids, carbohydrates, and nucleic acids serve important roles in biological systems, they do not exhibit the catalytic characteristics of enzymes. Lipids primarily function as structural components of cell membranes and as energy storage molecules. Carbohydrates are mainly involved in energy storage and providing structural support in cells. Nucleic acids, such as DNA and RNA, are responsible for storing and transmitting genetic information. Therefore, the classification of enzymes as proteins highlights their unique role in catalyzing reactions essential for life.

4. How can two types of protein synthesis in eukaryotic cells be distinguished?

A. Based on RNA type

B. Polyribosome types

C. Type of DNA

D. Type of amino acids

The correct choice identifies that the two types of protein synthesis in eukaryotic cells can be distinguished by polyribosome types. In eukaryotic cells, there are two primary locations for protein synthesis: the endoplasmic reticulum (ER) and the cytoplasm. When ribosomes are associated with the rough ER, they form polyribosomes that synthesize proteins destined for secretion or for use in the cell membrane. In contrast, free ribosomes in the cytoplasm form different polyribosomes that synthesize proteins meant for use within the cell itself. Thus, distinguishing between polyribosome types reflects the compartmentalization in eukaryotic cells, where different environments lead to the synthesis of different types of proteins based on their final destination and function. This understanding is fundamental to grasping how gene expression is regulated and how proteins are targeted to their appropriate cellular locales.

5. Amino acids that cannot be synthesized by the body and must be obtained from diet are known as what?

A. Non-essential amino acids

B. Conditional amino acids

C. Essential amino acids

D. Supplemental amino acids

Amino acids that cannot be synthesized by the body and must be obtained through the diet are referred to as essential amino acids. These amino acids are necessary for various physiological functions, including protein synthesis, tissue repair, and the production of hormones and neurotransmitters. Since the body lacks the ability to produce them, it relies entirely on dietary sources for these critical components. In contrast, non-essential amino acids can be synthesized by the body, making them unnecessary to include in the diet. Conditional amino acids are typically non-essential but can become essential under certain stress conditions or illness. Supplemental amino acids are not a recognized category of amino acids but rather refer to amino acids provided through supplements to enhance intake. Thus, the classification of essential amino acids uniquely identifies those that must be sourced externally through food.

6. In what way is the making of a primary lysosome similar to the enzymes delivered by the pancreas?

A. Both are made by membrane bound polyribosomes

B. Both are activated by pH changes in the stomach

C. Both contain ribosomal RNA

D. Both are stored in vesicles until needed

The production of a primary lysosome shares similarities with the enzymes delivered by the pancreas in that both are synthesized by membrane-bound polyribosomes. In eukaryotic cells, membrane-bound polyribosomes are responsible for translating mRNA that codes for proteins destined for secretion or for insertion into membranes, such as the enzymes produced by the pancreas, which are important for digestion. Similarly, the enzymes within primary lysosomes are synthesized in this manner, as lysosomal enzymes are produced in the rough endoplasmic reticulum, where they are initially synthesized as precursors before being packaged into vesicles and transported to the lysosome. This commonality in their production highlights a critical aspect of cellular function in utilizing ribosomes attached to membranes to direct the synthesis of proteins that play vital roles in cell metabolism and digestion. The other options do not reflect the same process: for example, the enzymes from the pancreas are not activated by pH changes in the stomach prior to being made; rather, they are secreted in an inactive form and then activated in the intestine, making that option inaccurate. Similarly, both lysosomal enzymes and pancreatic enzymes are not activated or stored in the same manner, nor do they have the same components when considered at the molecular level,

7. Which organelle is responsible for energy production in eukaryotic cells?

A. Nucleus

B. Mitochondria

C. Endoplasmic reticulum

D. Golgi apparatus

Mitochondria are often referred to as the "powerhouses" of eukaryotic cells because they are the organelles that generate adenosine triphosphate (ATP), the main energy currency of the cell. They accomplish this through a process known as cellular respiration, which involves the breakdown of glucose and other nutrients in the presence of oxygen to produce ATP. The structure of mitochondria is also key to their function; they have a double membrane that creates compartments within the organelle, allowing for the electron transport chain and other steps of respiration to occur efficiently. This compartmentalization is essential for creating a distinct environment where the processes can take place optimally. In contrast, the nucleus is primarily responsible for storing genetic information and coordinating cellular activities, such as growth and reproduction. The endoplasmic reticulum plays a role in the synthesis of proteins and lipids, while the Golgi apparatus is involved in modifying, sorting, and packaging these proteins and lipids for secretion or delivery to other organelles. Thus, while all these organelles are important for the overall functioning of the cell, mitochondria specifically are the ones that directly produce energy.

8. Which enzyme is the first to be added during digestion in the mouth?

A. Protease

B. Amylase

C. Pepsin

D. Lipase

Amylase is the first enzyme introduced during digestion in the mouth, making it vital for the initial breakdown of carbohydrates. Specifically, salivary amylase (also known as ptyalin) is secreted by the salivary glands and begins the process of starch digestion while food is still in the mouth. It hydrolyzes starch into maltose and dextrins, facilitating easier digestion as the food moves through the digestive system. In contrast, proteases are enzymes that break down proteins and are primarily active in the stomach, where conditions are more suitable for protein digestion. Pepsin is actually the main protease active in the stomach, not the mouth, and is secreted in an inactive form called pepsinogen. Lipase, while important for lipid digestion, is also not the primary enzyme active in the mouth; it functions later in the digestive process, primarily in the stomach and small intestine, for the breakdown of fats. This focus on amylase emphasizes the starting point of carbohydrate digestion in the mouth, highlighting the specialized function of enzymes in different sections of the digestive system.

9. What is the function of the nuclear envelope?

A. To provide energy to the cell

B. To protect the nucleus and regulate the movement of materials in and out

C. To synthesize ribosomal RNA

D. To facilitate protein synthesis

The nuclear envelope serves as a crucial barrier that both protects the nucleus and regulates the movement of materials between the nucleus and the cytoplasm. It consists of two lipid bilayer membranes with spaces in between known as the perinuclear space. The nuclear envelope is dotted with structures called nuclear pores, which are large protein complexes that control the passage of molecules. Specifically, this regulate the movement of vital substances such as RNA and proteins; for instance, messenger RNA (mRNA), which is synthesized in the nucleus during transcription, must exit the nucleus through these pores to reach ribosomes in the cytoplasm where translation occurs. The nuclear envelope also helps maintain the shape and integrity of the nucleus, protecting the genetic material inside from potential damage that could arise from interactions with other cellular components or the external environment.

10. Which strand of DNA is produced more rapidly during replication?

A. Leading strand

B. Lagging strand

C. Replication fork

D. Okazaki strand

During DNA replication, the leading strand is synthesized continuously in the same direction as the movement of the replication fork. This allows DNA polymerase to add nucleotides in a streamlined manner without the need for additional mechanisms to connect fragments. The leading strand is constructed in a continuous fashion as it follows the unwinding of the double helix, resulting in a more rapid synthesis compared to the other strand. In contrast, the lagging strand is produced in short segments known as Okazaki fragments because it is synthesized in the opposite direction to the movement of the replication fork. This means that DNA polymerase must frequently stop and start, which naturally makes the lagging strand synthesis slower and more discontinuous. The replication fork refers to the area where the DNA double helix is unwound, but it does not refer to a specific strand being synthesized, while the Okazaki fragments are the short segments produced on the lagging strand and are not a distinct strand themselves. Thus, the leading strand is synthesized more quickly than the lagging strand during DNA replication.