

Rutgers Anatomy & Physiology Test Practice (Sample)

Study Guide



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Questions

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- 1. Active muscle contraction requires a sufficient supply of which molecule?**
 - A. Glucose**
 - B. Oxygen**
 - C. ATP**
 - D. Calcium**
- 2. Where is a brain tumor likely located if a patient is experiencing mood swings, thirst, and hunger disturbances?**
 - A. Frontal lobe**
 - B. Hypothalamus**
 - C. Occipital lobe**
 - D. Cerebellum**
- 3. Glucose is categorized under which type of carbohydrates?**
 - A. Disaccharides**
 - B. Polysaccharides**
 - C. Oligosaccharides**
 - D. Monosaccharides**
- 4. Which four elements make up over 95% of the human body?**
 - A. Carbon, nitrogen, oxygen, and iron**
 - B. Hydrogen, sulfur, phosphorus, and oxygen**
 - C. Oxygen, carbon, hydrogen, and nitrogen**
 - D. Sodium, potassium, calcium, and magnesium**
- 5. What is the term for the non-living intracellular material found in connective tissue?**
 - A. Fibers**
 - B. Matrix**
 - C. Ground substance**
 - D. Cellular fluid**

- 6. Which process requires energy to move substances against their concentration gradient?**
- A. Diffusion**
 - B. Facilitated diffusion**
 - C. Active transport**
 - D. Osmosis**
- 7. If you bruised your gluteus maximus, what activity would most likely cause discomfort?**
- A. Walking**
 - B. Extending your hip and laterally rotating it**
 - C. Running**
 - D. Sitting down**
- 8. Which structure is primarily responsible for the selective permeability of a cell?**
- A. Cell wall**
 - B. Cytoplasm**
 - C. Cell membrane**
 - D. Nucleus**
- 9. Which connective tissue provides support and rigidity and makes up the skeleton?**
- A. Cartilage**
 - B. Blood**
 - C. Bone**
 - D. Connective tissue proper**
- 10. Which type of joint demonstrates the greatest range of motion?**
- A. Hinge**
 - B. Immovable**
 - C. Ball and socket**
 - D. Saddle joint**

Answers

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

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Explanations

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1. Active muscle contraction requires a sufficient supply of which molecule?

- A. Glucose**
- B. Oxygen**
- C. ATP**
- D. Calcium**

Active muscle contraction primarily requires adenosine triphosphate (ATP). ATP is the energy currency of the cell, and during muscle contraction, it is utilized to power the interactions between actin and myosin filaments within the muscle fibers. When a muscle is activated by a nerve impulse, calcium ions are released, allowing these sliding filament mechanisms to take place. However, without ATP, the muscle cannot maintain its contracted state or relax afterward, as the ATP is also needed for detaching myosin heads from the actin filaments once contraction has occurred. While glucose and oxygen are important for the production of ATP through cellular respiration, ATP itself is the immediate source of energy for muscle contraction. Calcium is critical for the initiation of contraction but does not directly provide the energy needed for the contraction process. Therefore, understanding the role of ATP in muscle physiology is essential for grasping how muscles function during activity.

2. Where is a brain tumor likely located if a patient is experiencing mood swings, thirst, and hunger disturbances?

- A. Frontal lobe**
- B. Hypothalamus**
- C. Occipital lobe**
- D. Cerebellum**

The hypothalamus plays a crucial role in regulating various autonomic functions of the body, including mood, thirst, and hunger. It acts as a critical control center that maintains homeostasis by regulating hormonal activity, emotional responses, and basic bodily drives such as hunger and thirst. When a tumor affects the hypothalamus, it can disrupt these regulatory functions, leading to symptoms such as mood swings due to its influence on emotional behavior, increased thirst (polydipsia), and changes in appetite or hunger (polyphagia). These disturbances occur because the hypothalamus interacts with other regions in the brain that govern emotion and motivation, making it central to these types of symptoms. In contrast, the frontal lobe is primarily involved in higher cognitive functions, decision-making, and personality, while the occipital lobe is responsible for visual processing. The cerebellum primarily coordinates movement and balance and does not directly involve the regulation of thirst or hunger. Therefore, given the symptoms presented, the hypothalamus is the most logical location for a tumor related to disturbances in mood, thirst, and hunger.

3. Glucose is categorized under which type of carbohydrates?

- A. Disaccharides**
- B. Polysaccharides**
- C. Oligosaccharides**
- D. Monosaccharides**

Glucose is classified as a monosaccharide, which is the simplest form of carbohydrates. Monosaccharides are single sugar units that can be absorbed directly into the bloodstream and are used by the body for energy. They serve as the building blocks for more complex carbohydrates. In contrast, disaccharides are composed of two monosaccharide units linked together; examples include sucrose and lactose. Polysaccharides consist of long chains of monosaccharide units and include starch and glycogen, which store energy. Oligosaccharides are slightly more complex, containing a few (typically 2 to 10) monosaccharides linked together. The classification of glucose as a monosaccharide highlights its fundamental role in metabolism and its importance as a direct energy source for cells.

4. Which four elements make up over 95% of the human body?

- A. Carbon, nitrogen, oxygen, and iron**
- B. Hydrogen, sulfur, phosphorus, and oxygen**
- C. Oxygen, carbon, hydrogen, and nitrogen**
- D. Sodium, potassium, calcium, and magnesium**

The four elements that make up over 95% of the human body are oxygen, carbon, hydrogen, and nitrogen. These elements are fundamental to the structure and function of biological molecules. Oxygen is a major component of water, which makes up a large portion of the human body, and it is also critical for cellular respiration—a process that produces energy. Carbon serves as the backbone for all organic molecules, including proteins, lipids, carbohydrates, and nucleic acids, making it essential for life. Hydrogen, found in water and organic molecules, is involved in energy production and chemical reactions within the body. Nitrogen is a vital component of amino acids, which are the building blocks of proteins, and nucleotides, which make up DNA and RNA. In contrast, the other choices include elements that, while important, do not collectively contribute to over 95% of the body's composition. For example, iron, sulfur, phosphorus, sodium, potassium, calcium, and magnesium play crucial roles in various bodily functions, but they are present in much smaller quantities compared to oxygen, carbon, hydrogen, and nitrogen. Thus, the choice accurately reflects the primary elements essential for maintaining the structure and physiological processes of the human body.

5. What is the term for the non-living intracellular material found in connective tissue?

A. Fibers

B. Matrix

C. Ground substance

D. Cellular fluid

The term that refers to the non-living intracellular material found in connective tissue is the matrix. The matrix is a complex mixture that typically includes ground substance, fibers, and other components that provide a structural framework for the cells within the connective tissue. In connective tissues, the matrix plays a critical role in providing support, strength, and elasticity. It consists of a variety of proteins and polysaccharides that can vary widely depending on the specific type of connective tissue. The matrix not only fills the spaces between the cells but also facilitates the exchange of nutrients and waste products between the blood and cells. Understanding the matrix's function is essential for grasping how different connective tissues maintain their roles in the body, including cartilage, bone, adipose tissue, and blood. Each connective tissue type has a unique composition of matrix that contributes to its specific functions and properties, making the concept of the matrix fundamental in the study of anatomy and physiology.

6. Which process requires energy to move substances against their concentration gradient?

A. Diffusion

B. Facilitated diffusion

C. Active transport

D. Osmosis

Active transport is the correct process that requires energy to move substances against their concentration gradient. This means that during active transport, molecules are transported from an area of lower concentration to an area of higher concentration, which is contrary to the natural direction of diffusion where substances move from higher to lower concentrations. This process typically utilizes ATP (adenosine triphosphate) as the energy source to power transport proteins in the cell membrane. These proteins can be specific for certain molecules, allowing for selective uptake or expulsion of substances vital for the cell's functions, such as ions, glucose, and amino acids. In contrast, diffusion, facilitated diffusion, and osmosis do not require energy because they rely on the natural kinetic movement of molecules to achieve equilibrium. Diffusion allows substances to move freely along their concentration gradient, while facilitated diffusion uses a transport protein but still moves substances down their gradient. Osmosis specifically refers to the movement of water across a semipermeable membrane and similarly follows its concentration gradient.

7. If you bruised your gluteus maximus, what activity would most likely cause discomfort?

A. Walking

B. Extending your hip and laterally rotating it

C. Running

D. Sitting down

The gluteus maximus is the largest muscle in the body and plays a significant role in hip extension and lateral rotation of the hip joint. If you have bruised this muscle, activities that directly involve its primary movements would likely cause discomfort. Extending the hip, which involves moving the thigh backward from a flexed position (like when standing up from a sitting position or when walking up stairs), requires significant engagement of the gluteus maximus. Additionally, lateral rotation of the hip also engages this muscle. Therefore, performing activities or movements that require these actions — like extending your hip and laterally rotating it — would exacerbate the pain and discomfort from the bruised muscle. While walking, running, or sitting down may also engage the gluteus maximus to some extent, they do not target the muscle as specifically or intensely as the action of extending and laterally rotating the hip does. This makes the hip extension and lateral rotation the most likely cause of discomfort when the gluteus maximus is bruised.

8. Which structure is primarily responsible for the selective permeability of a cell?

A. Cell wall

B. Cytoplasm

C. Cell membrane

D. Nucleus

The cell membrane, also known as the plasma membrane, is primarily responsible for the selective permeability of a cell. This characteristic allows the cell to maintain homeostasis by controlling the movement of substances in and out of the cell. The structure of the cell membrane consists of a double layer of phospholipids along with embedded proteins, which create a barrier that is fluid and dynamic. These properties enable the membrane to selectively allow certain molecules to pass while restricting others based on factors such as size, charge, and solubility. Transport mechanisms like diffusion, facilitated diffusion, and active transport are all influenced by the structure of the cell membrane, which strategically regulates the exchange of ions, nutrients, and waste products. Other structures mentioned, such as the cell wall, cytoplasm, and nucleus, do play roles in various cellular functions, but they do not primarily govern the selective permeability. The cell wall, found in plant cells, provides structural support and protection but is not selectively permeable in the same dynamic way as the cell membrane. The cytoplasm is the site for cellular processes but does not contribute to selective permeability. The nucleus houses the genetic material and manages cellular activities, but it does not interact directly with the transport of substances across the cell boundary.

9. Which connective tissue provides support and rigidity and makes up the skeleton?

A. Cartilage

B. Blood

C. Bone

D. Connective tissue proper

The correct answer is bone, as it serves as the primary connective tissue that provides structural support and rigidity to the skeleton. Bone is composed of a dense matrix of mineralized collagen fibers, which grants it strength and the ability to bear weight. It plays a critical role in protecting vital organs, enabling movement by serving as levers for muscles, storing minerals such as calcium and phosphorus, and housing the bone marrow for blood cell production. While cartilage is also a type of connective tissue that provides support, it does not offer the same level of rigidity as bone. Cartilage is more flexible and serves as a cushion in joints and certain structures, such as the nose and ears, but it lacks the mineral content that gives bone its hardness. Blood, although classified as a connective tissue, mainly functions in transportation rather than providing structural support. Connective tissue proper encompasses a variety of tissue types (like tendons and ligaments) that support and bind other tissues together, but it does not fulfill the specific role of forming the skeleton. Thus, bone is uniquely suited to this function within the body.

10. Which type of joint demonstrates the greatest range of motion?

A. Hinge

B. Immovable

C. Ball and socket

D. Saddle joint

The type of joint that demonstrates the greatest range of motion is the ball and socket joint. This particular joint allows for movement in multiple directions—flexion, extension, abduction, adduction, and rotation—due to its structure, which consists of a spherical head of one bone fitting into a cup-shaped socket of another bone. The expansive range of motion enabled by ball and socket joints is exemplified by the shoulder and hip joints. In these joints, the spherical shape of the bone head creates a complex and versatile movement capability, allowing limbs to rotate and move in circular paths. This makes ball and socket joints particularly important for activities requiring significant mobility, such as throwing or walking. In contrast, other types of joints, such as hinge joints, provide limited motion primarily to one plane (like the elbow or knee), while immovable joints allow no movement at all, and saddle joints facilitate movement but still have more constraints compared to ball and socket joints.