SQA National 5 Biology Practice Exam Sample Study Guide

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Questions

1. What term describes a genotype in which the two alleles for the characteristic are different?

A. Homozygous

B. Heterozygous

C. Dominant

D. Recessive

2. What process allows the genetic information from one organism to be changed?

A. Gene editing

B. Mutation

C. Transcription

D. Translation

3. Which simple sugar is used as a respiratory substrate for the production of ATP?

A. Glucose

B. Fructose

C. Sucrose

D. Galactose

4. What role does haemoglobin play in the circulatory system?

A. Transports nutrients

B. Transports carbon dioxide

C. Transports oxygen

D. Regulates blood pressure

5. What does an indicator species help determine in an ecosystem?

A. Species diversity

B. Conservation status

C. Level of pollution

D. Predator-prey relationships

6. What are the optimal conditions for enzyme activity called?

A. Temperature Regulation

B. Optimum

C. Homeostasis

D. Activation Energy

7. What organelle contains the genetic information of an organism?

A. Mitochondrion

B. Nucleus

C. Chloroplast

D. Endoplasmic Reticulum

8. What term refers to the process by which cells can respond to environmental changes?

A. Cell signaling

B. Responses

C. Stimuli

D. Cell communication

9. Which vein carries deoxygenated blood back to the heart from the body systems?

A. Pulmonary vein

B. Vella

C. Vena cava

D. Coronary vein

10. What part of the central nervous system runs within the backbone of mammals?

A. Brain

B. Spinal cord

C. Nerve bundle

D. Cerebrum

Answers

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

Explanations

1. What term describes a genotype in which the two alleles for the characteristic are different?

A. Homozygous

B. Heterozygous

C. Dominant

D. Recessive

The term that describes a genotype in which the two alleles for a characteristic are different is heterozygous. In genetics, an organism's genotype consists of the alleles it possesses for a particular gene. When these alleles are not identical, or one allele is different from the other, the genotype is referred to as heterozygous. For example, if we consider a trait influenced by a pair of alleles, such as flower color, a plant with one allele for red flowers and another for white flowers would be heterozygous for that trait. This contrasts with homozygous, where both alleles would be the same, such as having two alleles for red flowers. The other terms listed do have important roles in genetics but are not relevant to the specific question about the difference between alleles. Dominant and recessive refer to the behavior of these alleles in terms of their phenotypic expression, but they do not indicate whether the alleles are the same or different.

2. What process allows the genetic information from one organism to be changed?

A. Gene editing

B. Mutation

C. Transcription

D. Translation

Gene editing is the correct answer because it refers to a set of technologies that either add, remove, or alter genetic material at particular locations in the genome of an organism. Techniques such as CRISPR-Cas9 are prominent examples of gene editing, allowing precise modifications in the DNA sequence. This process enables scientists to directly change genetic information, which can be used in a variety of applications, from agriculture to medicine, ensuring that the genetic makeup of organisms can be tailored for specific traits or characteristics. Other processes listed do not directly involve changing genetic information in the same way. Mutation refers to naturally occurring changes in the DNA sequence that can happen over time due to various factors, but it is not a deliberate or controlled process like gene editing. Transcription and translation are essential stages in the process of gene expression—transcription is the process of synthesizing RNA from a DNA template, while translation is the conversion of RNA into a protein—but neither actually modifies the genetic material itself. They are crucial for the expression of genes but do not change the underlying genetic code.

3. Which simple sugar is used as a respiratory substrate for the production of ATP?

A. Glucose

B. Fructose

C. Sucrose

D. Galactose

Glucose is the primary simple sugar utilized as a respiratory substrate for the production of ATP. During cellular respiration, glucose undergoes a series of metabolic pathways, including glycolysis, the citric acid cycle (Krebs cycle), and the electron transport chain, to ultimately produce ATP, the energy currency of the cell. This process begins with glycolysis, where glucose is broken down into pyruvate, generating some ATP and reducing power in the form of NADH. The pyruvate then enters the mitochondria (in aerobe conditions), where it is further processed to yield more ATP through aerobic respiration. Other sugars like fructose and galactose can also enter metabolic pathways to produce ATP but generally are not as direct or efficient as glucose in terms of their role as primary respiratory substrates. Sucrose, being a disaccharide composed of glucose and fructose, must first be hydrolyzed into its constituent monosaccharides before contributing to ATP production. Thus, while these sugars can be utilized by the body, glucose stands out as the main simple sugar in metabolic processes directly linked to ATP generation.

4. What role does haemoglobin play in the circulatory system?

A. Transports nutrients

B. Transports carbon dioxide

C. Transports oxygen

D. Regulates blood pressure

Haemoglobin plays a crucial role in the circulatory system by transporting oxygen from the lungs to the tissues and organs throughout the body. It is a specialized protein found in red blood cells, allowing them to carry oxygen efficiently. When inhaled air reaches the lungs, oxygen diffuses into the bloodstream and binds to haemoglobin molecules, forming oxyhaemoglobin. This complex is then transported via the bloodstream to various cells where oxygen is released for cellular respiration, a process essential for producing energy in the form of ATP. Haemoglobin's ability to pick up and release oxygen is vital for maintaining the metabolic needs of cells; it ensures that all body tissues receive adequate oxygen supply. While haemoglobin can also play a role in transporting carbon dioxide back to the lungs for exhalation, its primary and critical function is the transport of oxygen.

5. What does an indicator species help determine in an ecosystem?

A. Species diversity

B. Conservation status

C. Level of pollution

D. Predator-prey relationships

An indicator species is a type of organism that provides insight into the health of an ecosystem, particularly in relation to environmental conditions. The primary role of an indicator species is to signal the level of pollution within a habitat. These species are sensitive to changes in their environment and can reflect the impacts of pollutants such as heavy metals, chemicals, or changes in pH. When the population of an indicator species declines or changes in health, it serves as a warning that the ecosystem is experiencing stress due to pollution. For example, certain species of lichen are known to be sensitive to air quality; their presence often indicates clean air, while their absence may suggest higher levels of air pollution. Similarly, in aquatic environments, specific species of fish or invertebrates can indicate levels of water pollution or changes in water quality. While species diversity, conservation status, and predator-prey relationships are important aspects of ecosystem dynamics, they do not specifically indicate pollution levels in the same way that indicator species do. Thus, understanding the role of indicator species is crucial for assessing the health of an ecosystem and determining the impact of pollution on the environment.

6. What are the optimal conditions for enzyme activity called?

A. Temperature Regulation

B. Optimum

C. Homeostasis

D. Activation Energy

The optimal conditions for enzyme activity are referred to as "optimum." This term specifically describes the ideal environment in which an enzyme functions most effectively, including factors like temperature and pH. Each enzyme has a specific optimum temperature and pH range that allows it to catalyze reactions at the highest rate. When conditions deviate significantly from this optimum, enzyme activity may decrease due to changes in the enzyme's structure or the substrate's stability. Other choices do not accurately define the optimal conditions for enzyme activity. Temperature regulation refers to the process of maintaining an even temperature but does not specifically denote the best conditions for enzyme function. Homeostasis is a broader term that encompasses the maintenance of a stable internal environment in an organism, including but not limited to enzyme activity. Activation energy is the energy required to initiate a chemical reaction and is not related to the optimal conditions for enzyme performance.

7. What organelle contains the genetic information of an organism?

A. Mitochondrion

B. Nucleus

C. Chloroplast

D. Endoplasmic Reticulum

The nucleus is the organelle that contains the genetic information of an organism. It houses the cell's DNA, which is organized into chromosomes. This genetic material carries the instructions necessary for the growth, development, functioning, and reproduction of the organism. The DNA in the nucleus is crucial for processes such as cell division, where it ensures that genetic information is accurately copied and passed on to daughter cells. In addition to housing DNA, the nucleus is also the site where RNA is transcribed from DNA, which plays a key role in protein synthesis. This process is essential, as proteins perform a wide range of functions within the cell, from structural roles to serving as enzymes to facilitate biochemical reactions. The other organelles listed, while important for various cellular functions, do not contain genetic information. Mitochondria are primarily involved in energy production, chloroplasts in photosynthesis, and the endoplasmic reticulum in protein and lipid synthesis, but none of these organelles house the genetic material like the nucleus does.

8. What term refers to the process by which cells can respond to environmental changes?

A. Cell signaling

B. Responses

C. Stimuli

D. Cell communication

The term that refers to the process by which cells can respond to environmental changes is cell signaling. This process involves various molecular interactions that allow cells to detect and respond to external signals, such as hormones, nutrients, or other environmental factors. Cell signaling encompasses a variety of mechanisms, including the reception of signals through specific receptors on the cell surface, transduction of that signal through intracellular pathways, and ultimately leading to a cellular response, which may involve changes in gene expression, metabolism, or cell behavior. This connectivity is critical for maintaining homeostasis, coordinating developmental processes, and enabling cells to adapt to their surroundings. The other terms provided do not capture the specific process of how cells interpret and respond to environmental cues as effectively as cell signaling does. For instance, responses are the outcomes of signaling and do not illustrate the signaling pathway itself. Stimuli are the external factors that provoke responses but do not encompass the cellular communication process. Cell communication is a broader term that may include signaling but does not specifically emphasize the signaling mechanism that leads to cellular responses.

9. Which vein carries deoxygenated blood back to the heart from the body systems?

A. Pulmonary vein

B. Vella

C. Vena cava

D. Coronary vein

The vena cava is the vein responsible for carrying deoxygenated blood back to the heart from the body systems. There are two vena cavae: the superior vena cava, which collects blood from the upper body, and the inferior vena cava, which collects blood from the lower body. Once the deoxygenated blood reaches the vena cava, it is directed into the right atrium of the heart, where it will eventually be pumped into the lungs for oxygenation. This process is essential for maintaining the circulation of blood throughout the body and ensuring that oxygen-depleted blood is efficiently returned to the heart. The pulmonary vein is responsible for transporting oxygenated blood from the lungs to the heart, while the coronary vein primarily drains deoxygenated blood from the heart muscle itself back to the right atrium. "Vella" appears to be a non-standard term in this context and does not pertain to a known biological structure related to blood circulation.

10. What part of the central nervous system runs within the backbone of mammals?

A. Brain

B. Spinal cord

C. Nerve bundle

D. Cerebrum

The spinal cord is the correct answer because it is a vital part of the central nervous system that is housed within the vertebral column, commonly known as the backbone. It serves as a major conduit for information traveling between the brain and the rest of the body. The spinal cord is protected by the bony vertebrae, which form the backbone, and its primary functions include transmitting nerve signals and coordinating reflexes. The brain, while also a crucial component of the central nervous system, is located in the skull and not within the backbone. A nerve bundle refers to a collection of nerves outside the central nervous system and does not specifically refer to an internal structure. The cerebrum is part of the brain, responsible for higher functions such as thought and action, and like the brain, it is not located in the backbone.