ABCTE Biology Practice Exam (Sample)

Study Guide

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Questions

1. Under what condition will an offspring express an autosomal recessive condition?

A. It has the dominant gene for that condition.

B. It is heterozygous for the gene that causes the condition.

C. It is homozygous for the gene that causes the condition.

D. It has inherited the recessive genes from its mother.

2. What two substances provide rigidity to the plant cell wall?

A. Microtubules and lignin

B. Cellulose and thylakoids

C. Lignin and cellulose

D. Grana and chlorophyll

3. What type of galaxy lacks spiral arms and typically has an oval shape?

A. A Spiral galaxy

B. B Elliptical galaxy

C. C Irregular galaxy

D. D Lenticular galaxy

4. How does the scientific method typically function?

A. Hypotheses are proven through elegant experiments that clearly show that the hypotheses cannot be refuted.

B. Hypotheses are tested and refuted, and new hypotheses are generated to complete the cycle.

C. Falsifiable hypotheses are based on observations and sometimes refuted; if unable to be refuted, they become laws.

D. Falsifiable hypotheses are tested; sometimes they are refuted, and new hypotheses are generated as a result.

5. In which scenario is polygenic inheritance most likely to be observed?

A. When a single trait is influenced by multiple genes.

B. When traits exhibit complete dominance.

C. When traits exhibit codominance.

D. When two alleles compete for expression.

6. Which of the following is an example of a homogeneous mixture?

A. A chocolate chip cookie

B. The air we breathe

C. A piece of aluminum foil

D. A piece of wood

7. What term describes unicellular algae found on the surface of water bodies?

A. Colonial

B. Plankton

C. Euglenas

D. Dinoflagellates

8. In which domain can a prokaryote be classified?

A. A Chordata

B. B Archaea

C. C Animalia

D. D Eukarya

9. Which gas is utilized by plants during photosynthesis?

A. Oxygen

B. Carbon monoxide

C. Carbon dioxide

D. Methane

10. Which of the following is one nonspecific defense against invaders to the body?

A. White blood cells

B. Vaccine

C. Antibodies

D. Mucous membranes

Answers

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

Explanations

1. Under what condition will an offspring express an autosomal recessive condition?

A. It has the dominant gene for that condition.

B. It is heterozygous for the gene that causes the condition.

C. It is homozygous for the gene that causes the condition.

D. It has inherited the recessive genes from its mother.

For an offspring to express an autosomal recessive condition, it must be homozygous for the recessive allele associated with that condition. This means the offspring must inherit two copies of the recessive gene—one from each parent. The presence of one dominant allele is sufficient to mask the expression of the recessive allele, resulting in the dominant phenotype. Therefore, only when an individual possesses two recessive alleles does the autosomal recessive condition manifest itself. This understanding is critical when analyzing genetic inheritance patterns, as it highlights the importance of both parental contributions. For example, if both parents are carriers of the recessive allele (heterozygous), there is a chance, typically 25%, that the offspring could inherit the recessive allele from both parents, thereby expressing the autosomal recessive condition.

2. What two substances provide rigidity to the plant cell wall?

A. Microtubules and lignin

B. Cellulose and thylakoids

C. Lignin and cellulose

D. Grana and chlorophyll

The correct answer identifies cellulose and lignin as the two substances that provide rigidity to the plant cell wall. Cellulose is a polysaccharide that forms a major structural component of plant cell walls. It consists of long chains of glucose molecules linked together, creating a rigid framework that helps maintain the plant's structure and integrity. The high tensile strength of cellulose allows plant cells to withstand internal pressures from water, enabling plants to grow upright. Lignin, on the other hand, is a complex organic polymer that adds additional strength and rigidity to the cell wall, particularly in woody plants. It fills the spaces between cellulose fibers, reinforcing the wall and contributing to the water-resistant properties of aquatic and terrestrial plants. This combination allows plants to develop a robust structure capable of supporting their height and withstanding various environmental stresses. In contrast, while thylakoids are part of the chloroplasts and are involved in photosynthesis, they do not contribute to the rigidity of the cell wall. Grana and chlorophyll are associated with the photosynthetic process but serve different functions related to energy capture rather than structural support. Therefore, the correct pairing for providing rigidity to the plant cell wall is indeed cellulose and lignin.

3. What type of galaxy lacks spiral arms and typically has an oval shape?

A. A Spiral galaxy

B. B Elliptical galaxy

C. C Irregular galaxy

D. D Lenticular galaxy

An elliptical galaxy is characterized by its smooth, oval shape and the absence of spiral arms. These galaxies can vary in shape from nearly spherical to more elongated forms. They mainly contain older stars and have less interstellar gas and dust compared to spiral galaxies, which is why they typically do not form new stars. The lack of distinct arms is a definitive feature that distinguishes elliptical galaxies from spiral and lenticular galaxies. In contrast, spiral galaxies feature prominent spiral arms composed of stars and nebulae, while irregular galaxies have no distinct shape or structure, resulting in a more chaotic appearance. Lenticular galaxies represent a transitional form between spiral and elliptical galaxies and may display a central bulge and a disk but typically lack the spiral arms seen in spirals. Therefore, the oval shape and absence of spiral arms clearly identify elliptical galaxies as the correct choice.

4. How does the scientific method typically function?

A. Hypotheses are proven through elegant experiments that clearly show that the hypotheses cannot be refuted.

B. Hypotheses are tested and refuted, and new hypotheses are generated to complete the cycle.

C. Falsifiable hypotheses are based on observations and sometimes refuted; if unable to be refuted, they become laws.

D. Falsifiable hypotheses are tested; sometimes they are refuted, and new hypotheses are generated as a result.

The scientific method is an iterative process that emphasizes the testing of falsifiable hypotheses. In this context, a hypothesis is an educated guess that can be tested through observation and experimentation. As hypotheses are evaluated through experiments, they may be supported or refuted based on the outcomes. When a hypothesis is tested, the results can either support the hypothesis, indicating that it is a plausible explanation for the observed phenomena, or refute it, suggesting that the hypothesis does not adequately explain the observations. If a hypothesis is refuted, it is essential in science to reconsider the underlying assumptions and generate new hypotheses. This cycle of testing, refuting, and generating new hypotheses fosters a deeper understanding of the subject matter and drives scientific inquiry forward. This understanding aligns with the iterative nature of science, where each experiment provides insights that prompt further questions and hypotheses. Thus, the correct choice reflects the dynamic nature of scientific exploration, where the findings contribute to the ongoing development of knowledge rather than asserting absolute truths.

5. In which scenario is polygenic inheritance most likely to be observed?

A. When a single trait is influenced by multiple genes.

B. When traits exhibit complete dominance.

C. When traits exhibit codominance.

D. When two alleles compete for expression.

Polygenic inheritance is characterized by the involvement of multiple genes influencing a single trait. This scenario leads to a continuous range of phenotypes, rather than distinct categories, such as those seen in traits controlled by a single gene. For example, human height and skin color are the result of the cumulative effect of several genes, each contributing to the final phenotype. In contrast, the other scenarios primarily focus on the interaction between alleles of a single gene rather than the influence of multiple genes on one trait. Complete dominance occurs when one allele completely masks the effect of another, codominance involves both alleles being fully expressed, and the competition of two alleles typically relates to single-gene inheritance rather than the polygenic trait spectrum. Therefore, the situation where multiple genes affect a single trait is where polygenic inheritance is most likely to be observed.

6. Which of the following is an example of a homogeneous mixture?

A. A chocolate chip cookie

B. The air we breathe

C. A piece of aluminum foil

D. A piece of wood

A homogeneous mixture is one in which the components that make up the mixture are uniformly distributed and cannot be distinguished from one another, even under a microscope. In this case, the air we breathe is a prime example of a homogeneous mixture because it is composed of a variety of gases, such as nitrogen, oxygen, carbon dioxide, and others, that are evenly mixed together. These gases do not separate and remain consistent throughout, making it impossible to identify different components without specialized equipment. In contrast, a chocolate chip cookie contains distinct components, such as chocolate chips and dough, which can be physically separated and are not uniformly distributed. A piece of aluminum foil is a pure substance, not a mixture, as it is made entirely of the element aluminum. Similarly, a piece of wood consists of various organic compounds and fibers, displaying varying structures and compositions, making it heterogeneous. Therefore, the air is the only option that exemplifies a homogeneous mixture.

7. What term describes unicellular algae found on the surface of water bodies?

A. Colonial

B. Plankton

C. Euglenas

D. Dinoflagellates

The term that describes unicellular algae found on the surface of water bodies is plankton. Plankton refers to a diverse collection of organisms that live in large bodies of freshwater and saltwater, suspended in the water column. This group includes both phytoplankton, which are photosynthetic organisms such as algae, and zooplankton, which are small animals that feed on phytoplankton. Phytoplankton typically float near the surface where there is adequate sunlight for photosynthesis, making them crucial to the aquatic food web and global oxygen production. Euglenas and dinoflagellates are specific types of phytoplankton, but they are part of the broader category that plankton covers. By calling these unicellular algae plankton, it encapsulates all those forms of life that share the characteristic of floating in the water and being transported by currents. Thus, plankton serves as the most accurate term for these unicellular algae found on the surface of water bodies.

8. In which domain can a prokaryote be classified?

A. A Chordata

B. B Archaea

C. C Animalia

D. D Eukarya

Prokaryotes are classified into two primary domains: Archaea and Bacteria. The domain Archaea encompasses prokaryotic organisms that are distinct from Bacteria and are often found in extreme environments, such as hot springs and salt lakes. They possess unique biochemical and genetic characteristics that differentiate them from other life forms. In the context of the question, the mention of Archaea reflects the understanding that prokaryotes lack the membrane-bound organelles found in eukaryotic cells, such as those classified under the domains Eukarya, which includes animals, plants, fungi, and protists. Chordata and Animalia are kingdoms within the Eukarya domain and refer specifically to more complex multicellular organisms that are not prokaryotes at all. Therefore, the classification of prokaryotes under the domain Archaea is well-founded scientifically.

9. Which gas is utilized by plants during photosynthesis?

A. Oxygen

B. Carbon monoxide

C. Carbon dioxide

D. Methane

Plants utilize carbon dioxide during photosynthesis as a key reactant in the process of converting light energy into chemical energy. During this process, they absorb carbon dioxide from the atmosphere through small openings in their leaves called stomata. The photosynthesis equation reflects this process: carbon dioxide combines with water in the presence of sunlight to produce glucose (a sugar used for energy) and oxygen as a byproduct. The glucose provides energy and serves as a building block for plant growth, while the oxygen is released back into the atmosphere, contributing to the air we breathe. In contrast, other gases listed, such as oxygen, carbon monoxide, and methane, do not play a role in photosynthesis. Oxygen is a byproduct of the photosynthetic process rather than a reactant. Carbon monoxide is toxic to plants and does not participate in metabolic processes like photosynthesis. Methane, while a gas that is produced by some living organisms, is not utilized by plants in photosynthesis. Thus, carbon dioxide is essential for the synthesis of organic compounds in plants, making it the correct answer.

10. Which of the following is one nonspecific defense against invaders to the body?

A. White blood cells

B. Vaccine

C. Antibodies

D. Mucous membranes

Mucous membranes serve as a key nonspecific defense mechanism in the body, providing a physical barrier against pathogens. These membranes line various cavities and organs, such as the respiratory and digestive tracts, and produce mucus, which traps dust, bacteria, and other foreign particles. This is an essential component of the innate immune system, which operates as a first line of defense, responding to any invader without the need for prior exposure or specific targeting. In contrast, the other options represent specific or more targeted responses to pathogens. White blood cells are components of both the nonspecific and specific immune systems, but they often require more specific responses to effectively deal with infections. Vaccines work by training the immune system to recognize and respond to specific pathogens, thus falling under the category of acquired immunity. Antibodies are produced by the immune system in response to specific antigens and are part of the adaptive immune response, targeting specific invaders rather than broadly defending against all.