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Practice Questions

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1. The following statements about the adaptation of animals to colder climates are all true, except:

- A. The transition was facilitated by selective pressures from changing temperatures
- B. Some animals developed specialized behaviors like hibernation
- C. Adaptations such as fur color change with seasons evolved
- D. Animals lost much of their fur as they adapted to colder climates

2. Given the different habitats in aquatic ecosystems, identify the main groups of algae based on their predominant pigmentation and structure. Algae Type Pigmentation Structure Green Algae Chlorophyll Varied forms, from unicellular to multicellular Red Algae Phycoerythrin Mostly multicellular Brown Algae Fucoxanthin Predominantly large and multicellular

- A. Green Algae = Fucoxanthin; Red Algae = Carotene; Brown Algae = Chlorophyll
- B. Green Algae = Carotene; Red Algae = Phycoerythrin; Brown Algae = Phycocyanin
- C. Green Algae = Chlorophyll; Red Algae = Phycoerythrin; Brown Algae = Fucoxanthin
- D. Green Algae = Phycoerythrin; Red Algae = Fucoxanthin; Brown Algae = Chlorophyll

3. Which of the following characteristics might be observed in a tundra biome? Characteristic Description i Extremely low temperatures ii High biodiversity iii Permafrost present iv High precipitation v Short growing seasons vi Dense tree cover

- A. i, ii, iii, and v
- B. ii, iv, and vi
- C. iii, iv, and vi
- D. i, iii, v, and vi

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4. In a population of plants, a trait such as flower color can be influenced by environmental conditions. What kind of genetic trait is this considered to be?

- A. On the X chromosome
- B. Only present in the phenotypes of one generation
- C. Present equally in phenotypes regardless of environment
- D. Multifactorial

5. In a population of wildflowers, the color of the petals is determined by a simple recessive genetic trait. Based on this trait, which generalization about the genetic appearance of flower color is most likely to be true?

- A. All flowers display the same color regardless of their genotype.
- B. Homozygous dominant flowers show the recessive color.
- C. Heterozygous flowers show an intermediate color between dominant and recessive.
- D. Recessive colors appear only when there are many dominant alleles.

6. Which of the following is the most accurate example of migration behavior?

- A. A squirrel stores food in various locations during the fall
- B. A chameleon changes its color to match the environment
- C. Monarch butterflies travel thousands of miles from North America to central Mexico for the winter
- D. Earthworms move to deeper soil layers during heavy rain to avoid drowning

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7. In a $Bb \times Bb$ cross involving two heterozygous rabbits, what are the genotypes of the offspring in terms of coat color?

- A. 75% BB (homozygous recessive), 25% bb (homozygous dominant)
- B. 100% Bb (both homozygous and heterozygous)
- C. 50% BB (homozygous recessive), 25% Bb (heterozygous), 25% bb (homozygous dominant)
- D. 25% BB (heterozygous dominant), 25% Bb (homozygous), 50% bb (heterozygous recessive)

8. In a population of mice, some individuals have brown fur, while others have white fur. A mouse with brown fur and a mouse with white fur possess different _____ of the same gene responsible for fur color.

- A. Proteins
- B. Genotypes
- C. Chromosomes
- D. Alleles



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9. For a study in an aquatic ecosystem, identify which of the following are examples of density-independent factors affecting fish populations: Statement i. Introduction of a new fish predator in the ecosystem ii. Toxic chemicals spilled into the water iii. Hurricanes causing widespread habitat destruction iv. Seasonal temperature changes leading to water stratification v. Increased competition for nesting sites

- A. ii, iii, and iv
- B. i, ii, iii, and iv
- C. ii and iii
- D. i, iv, and v

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10. Consider the following components as factors influencing the process of natural selection in a population: Component Description i. Variation in traits Differences in traits among individuals ii. Selective pressure Environmental factors that affect survival iii. Genetic mutations Changes in DNA sequence iv. Reproductive success Ability to produce offspring v. Gene inheritance Passing genes to the next generation Which of these components are essential for natural selection to occur?

- A. i, iii, and v
- B. i, ii, iii, and v
- C. iv and v
- D. ii, iii, iv, and v

11. Evaluate the table below to identify which factors contribute to increased biodiversity within an ecosystem. Factor Description Effect on Biodiversity Natural selection Adaptive traits become more prevalent Neutral Gene flow Movement of genes between populations Increase Overharvesting Excessive removal of species Decrease Mutation Random changes in DNA Increase

- A. Natural selection, gene flow, overharvesting, and mutation
- B. Gene flow and mutation
- C. Natural selection and mutation
- D. Gene flow and natural selection

12. The marine biome is characterized by an abundance of which animals?

- A. Large herbivores
- B. Reptiles
- C. Insects
- D. Birds



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13. Which component of the cell contains the enzymes needed for the Calvin cycle? Cell Component Function Chloroplast stroma Site of Calvin cycle Thylakoid membrane Site of light-dependent reactions Cytosol Site of glycolysis Nucleus Stores genetic material Mitochondrial matrix Site of Krebs cycle

- A. Chloroplast stroma
- B. Thylakoid membrane
- C. Cytosol
- D. Nucleus

14. What is the main structural difference between the plasma membrane of an animal cell and the cell wall of a fungal cell?

- A. Animal cell membranes contain cellulose; fungal cell walls do not.
- B. Animal cell membranes are strong and impermeable; fungal cell walls are flexible.
- C. Animal cell membranes have a crystalline structure; fungal cell walls are amorphous.
- D. Animal cell membranes are always rigid; fungal cell walls become flexible under heat.

15. During glycolysis, what occurs to glucose at the start of the pathway?

- A. It is entirely excreted from the cell
- B. It is converted into two molecules of pyruvate
- C. It directly enters the citric acid cycle
- D. It is transformed into an amino acid

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16. During the process of transcription, which statement correctly describes the relationship between the primary molecular components involved?

- A. DNA serves as a template to synthesize a complementary RNA sequence, where the RNA polymerase initiates and elongates the RNA chain.
- B. DNA is directly translated into proteins by ribosomes without involvement of RNA.
- C. RNA polymerase duplicates RNA strands directly into DNA molecules to synthesize proteins.
- D. RNA sequences are transcribed into DNA, which are then responsible for initiating transcription in the ribosome.



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17. Which of the following best describes the concept of enzymatic specificity?

- A. The nucleus selectively expressing only specific enzymes at all times
- B. Enzymes catalyzing reactions only with specific substrates due to their active site's shape
- C. Enzymes reacting with any substrate to produce energy
- D. DNA sequences that encode multiple enzymes that perform unrelated reactions

18. What is the primary role of codons found in mRNA during protein synthesis?

- A. To specify the sequence of amino acids in a protein
- B. To destroy misfolded proteins after synthesis
- C. To proofread the newly synthesized protein for accuracy
- D. To alter the structure of tRNA during translation

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19. Where would you expect to find cilia on a cell?

- A. Between the layers of the nuclear membrane
- B. Cell membrane exterior
- C. Nucleus exterior
- D. Cytoplasm interior

20. Identify which of the following conditions can lead to a permanent change in the DNA sequence of a bacterial cell. i. High levels of UV radiation ii. Mutagenic chemicals interacting with the DNA iii. Normal bacterial cell division iv. Oxidative stress within the cell

- A. i, ii, iii, and iv
- B. iv only
- C. i and ii only
- D. i, ii, and iv

21. Biologist Contribution Field of Study Watson and Crick DNA structure Genetics Gregor Mendel Laws of inheritance Heredity Charles Darwin Theory of evolution Natural selection Rosalind Franklin X-ray diffraction DNA research Based on the table above, which contribution by Rosalind Franklin was crucial in the study of DNA, complementing Watson and Crick's model?

- A. Gene therapy techniques
- B. X-ray diffraction
- C. Theory of evolution
- D. Laws of inheritance



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22. In flowering plants, from which tissues does a fruit typically develop?

- A. From the roots absorbing nutrients
- B. From the stem cells differentiating
- C. From the leaf tissues
- D. From the ovary tissue after fertilization

23. Refer to the table below and identify which nutrients are essential for animals to obtain from their diet. Nutrient Requirement for Animals Source Proteins Essential Diet Carbohydrates Non-essential Generated by digestion Vitamins Essential Diet Cholesterol Non-essential Synthesized by liver Minerals Essential Diet

- A. Proteins, Carbohydrates, and Cholesterol
- B. Proteins, Carbohydrates, Vitamins, Cholesterol, and Minerals
- C. Proteins, Vitamins, and Minerals
- D. Proteins, Cholesterol, and Carbohydrates

24. In mammals, what primarily regulates the circadian rhythm, often referred to as the biological clock?

- A. Body mass index
- B. Suprachiasmatic Nucleus
- C. Hormones
- D. External temperature cycles

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25. What passes through the gastroesophageal sphincter?

- A. Bolus
- B. Chyme
- C. Feces
- D. Stomach acid



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26. In mammals, how does sperm reach the egg during fertilization?

- A. Sperm are stored in the uterus until an egg passes by, at which point fertilization occurs in the uterus.
- B. Sperm are deposited on the surface of the ovaries where they fertilize any eggs ready for release.
- C. During mating, sperm are deposited near the cervix and travel through the cervix into the uterus. They continue into the fallopian tubes where fertilization of the egg occurs.
- D. Sperm are directly deposited into the fallopian tubes where they instantly fertilize the nearest egg.

**27. Which organisms can be classified as contributing significantly to the ecosystem's nutrient cycling through decomposition? Organism Type Function in Ecosystem
Fungi Decomposes organic material
Bacteria Breaks down organic material
Plants Produce oxygen and food
Predators Control prey population**

- A. Predators only
- B. Plants and Predators
- C. i, ii, iii, and iv
- D. Fungi and Bacteria

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**28. Examine the table below to identify which structures are part of the central nervous system and involved in processing sensory information. Structure System Function
Cerebrum Central nervous system Sensory/motor processing
Medulla oblongata Central nervous system Autonomic functions
Olfactory lobes Central nervous system Smell processing
Optic nerves Peripheral nervous system Vision transmission
Cerebellum Central nervous system Balance and coordination**

- A. Olfactory lobes, Cerebellum
- B. Medulla oblongata, Cerebellum
- C. Cerebrum, Olfactory lobes
- D. Medulla oblongata, Optic nerves

29. When you twist your ankle, which type of tissue is primarily affected?

- A. Ligament
- B. Bone
- C. Muscle
- D. Cartilage



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30. Examine the life cycle of angiosperms below. Which process results in the formation of fruit? Process Description Pollination Transfer of pollen from anther to stigma Fertilization Sperm nucleus fuses with egg to form zygote Fruit Formation Ovary matures into a fruit Seed Development Zygote develops into an embryo within a seed

- A. Seed Development: Zygote develops into an embryo within a seed
- B. Fertilization: Fusion of two ovules to form a diploid zygote
- C. Fruit Formation: Ovary matures into a fruit
- D. Pollination: Transfer of pollen from anther to stigma



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Answer Key & Explanations

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1. D — Animals lost much of their fur as they adapted to colder climates

Answer: Animals lost much of their fur as they adapted to colder climates. In colder climates, animals generally evolved to grow thicker fur, not lose it, to maintain body heat. Other adaptations include thicker fat layers and hibernation behaviors.

2. C — Green Algae = Chlorophyll; Red Algae = Phycoerythrin; Brown Algae = Fucoxanthin

Answer: Green Algae = Chlorophyll; Red Algae = Phycoerythrin; Brown Algae = Fucoxanthin. Green algae primarily contain chlorophyll, which gives them their characteristic green color. They can be found in various forms, from single-celled organisms to complex multicellular structures. Red algae are predominantly multicellular, and their red pigmentation is due to phycoerythrin, which allows them to photosynthesize in deeper waters. Brown algae, like the well-known kelps, are generally large and multicellular, characterized by their brown color due to the presence of fucoxanthin.

3. A — i, ii, iii, and v

Answer: i, iii, and v. The tundra biome is characterized by extremely low temperatures, presence of permafrost, and short growing seasons. Biodiversity is typically low due to harsh conditions, and dense tree cover is absent.

4. D — Multifactorial

Multifactorial traits are those where environmental factors as well as genetic factors contribute to the phenotype. Unlike purely autosomal traits, which are determined by a single gene, multifactorial traits may display variability due to environmental conditions.

5. A — All flowers display the same color regardless of their genotype.

Answer: Homozygous recessive flowers display the recessive color, while heterozygous flowers do not. In simple recessive genetic traits, two different alleles can occur. The recessive trait will only be displayed in the phenotype when both alleles are recessive (homozygous recessive). If the organism is heterozygous, the dominant trait will mask the recessive trait, meaning the recessive color will not be displayed.

6. C — Monarch butterflies travel thousands of miles from North America to central Mexico for the winter

Answer: Monarch butterflies travel thousands of miles from North America to central Mexico for the winter. Migration involves long-distance seasonal movement to a different territory. The earthworm example is an adaptation to environmental conditions, the cheetah example is a hunting tactic, the squirrel storing food is resource management, and the chameleon changing color is camouflaging.

7. A — 75% BB (homozygous recessive), 25% bb (homozygous dominant)

Answer: 25% BB (homozygous dominant), 50% Bb (heterozygous), 25% bb (homozygous recessive). To determine the genotypic ratios, draw a Punnett square. An individual is homozygous if the alleles are identical and heterozygous if not. Dominant alleles are represented by a capital letter while recessive alleles use a lowercase letter.



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**8. D — Alleles**

Answer: Alleles Alleles are different forms of the same gene, found at the same loci on the same chromosome. These alleles can result in variations in traits, such as fur color in mice.

9. A — ii, iii, and iv

Answer: ii, iii, and iv. Density-independent factors are abiotic factors that can impact population size irrespective of the population density. In this context, the spill of toxic chemicals, hurricanes, and seasonal temperature changes are abiotic factors, whereas a new predator and increased competition are biotic, density-dependent factors.

10. A — i, iii, and v

Answer: i, ii, and iv Variation in traits, selective pressure, and reproductive success are key components of natural selection. Genetic mutations and gene inheritance are mechanisms that contribute to these processes, but they are not required components for natural selection itself.

11. B — Gene flow and mutation

Gene flow and mutation both introduce new genetic variations, increasing biodiversity. Natural selection does not inherently increase biodiversity, as it often selects for specific traits, potentially reducing variation. Overharvesting decreases biodiversity by removing significant numbers of individuals from a population.

12. A — Large herbivores

Answer: Fish and marine mammals The marine biome, encompassing oceans and seas, is home to abundant fish and marine mammals due to its vast water resources and ecosystem diversity. Large herbivores typically inhabit savannah and grassland biomes, reptiles thrive in deserts and rainforests, insects can be found in most terrestrial biomes.

13. A — Chloroplast stroma

Answer: Chloroplast stroma The Calvin cycle occurs in the chloroplast stroma, where it utilizes ATP and NADPH generated by the light-dependent reactions in the thylakoid membrane.

14. A — Animal cell membranes contain cellulose; fungal cell walls do not.

Answer: Animal cell membranes are lipid bilayers without structural rigidity; fungal cell walls are strong due to chitin. The plasma membrane of animal cells is composed of a fluid lipid bilayer that provides flexibility and is not inherently rigid. In contrast, fungal cell walls are structured with chitin, which is tough and provides the structural rigidity needed for protection and support.

15. B — It is converted into two molecules of pyruvate

During glycolysis, glucose is broken down through a series of reactions into two molecules of pyruvate. This process generates a small amount of ATP and NADH. The pyruvate may then enter the mitochondria for further processing in the citric acid cycle if oxygen is present or be converted to lactate or ethanol if it is not.

16. A — DNA serves as a template to synthesize a complementary RNA sequence, where the RNA polymerase initiates and elongates the RNA chain.

Answer: DNA serves as a template to synthesize a complementary RNA sequence, where the RNA polymerase initiates and elongates the RNA chain. Transcription is the process in which a segment of DNA is used as a template to generate a complementary RNA strand. The enzyme RNA polymerase binds to a specific section of DNA and facilitates the unwinding of the DNA double helix, reading the DNA sequence to synthesize a corresponding RNA sequence. This process is fundamental for conveying genetic information



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from the DNA to be eventually translated into proteins.

17. B — Enzymes catalyzing reactions only with specific substrates due to their active site's shape

Answer: Enzymes catalyzing reactions only with specific substrates due to their active site's shape Enzymatic specificity refers to the ability of an enzyme to choose exact substrate molecules to catalyze a chemical reaction. This specificity is explained by the lock-and-key model, where the enzyme's active site binds only to specific substrates.

18. A — To specify the sequence of amino acids in a protein

Answer: To specify the sequence of amino acids in a protein mRNA consists of codons, which are sequences of three nucleotides that correspond to specific amino acids or stop signals during translation. The sequence of codons in mRNA determines the order of amino acids in a polypeptide chain, forming the primary structure of proteins.

19. B — Cell membrane exterior

Answer: Cell membrane exterior Cilia are hair-like extensions on the cell surface that help in movement and are involved in clearing particles from places like the respiratory tract.

20. D — i, ii, and iv

Answer: i, ii, and iv Permanent mutations in bacterial DNA can be induced by UV radiation, mutagenic chemicals, or oxidative stress. While normal bacterial cell division can introduce errors, it does not typically result in permanent mutations unless other factors are present.

21. B — X-ray diffraction

Rosalind Franklin's use of X-ray diffraction provided key evidence for the helical structure of DNA, supporting Watson and Crick's model of the double helix.

22. D — From the ovary tissue after fertilization

Answer: From the ovary tissue after fertilization In flowering plants, the fruit typically develops from the ovary tissue post-fertilization. The ovary swells and matures to form the fruit, which serves as a means to protect and disperse the seeds within.

23. C — Proteins, Vitamins, and Minerals

Answer: Proteins, Vitamins, and Minerals Proteins, vitamins, and minerals are necessary for animals as they cannot synthesize them and must obtain them from their diet. In contrast, carbohydrates can be produced by breaking down other nutrients, and cholesterol is synthesized by the liver.

24. B — Suprachiasmatic Nucleus

Answer: Suprachiasmatic Nucleus The suprachiasmatic nucleus (SCN) located in the hypothalamus is responsible for controlling circadian rhythms in mammals. It coordinates the body's internal clock by regulating hormone release and responding to environmental cues such as light.

25. A — Bolus

Answer: Bolus A bolus is a ball-like mixture of food and saliva that travels from the mouth to the stomach. It passes through the gastroesophageal sphincter (or cardiac sphincter) before entering the stomach for digestion.

26. C — During mating, sperm are deposited near the cervix and travel through the cervix into the uterus. They continue into the fallopian tubes where fertilization of the egg occurs.



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Answer: During mating, sperm are deposited near the cervix and travel through the cervix into the uterus. They continue into the fallopian tubes where fertilization of the egg occurs. The process usually begins with mating, during which sperm are transferred from the male to the female. The sperm travel through the female's reproductive tract, entering the cervix and progressing into the uterus. From there, they continue into the fallopian tubes. It is within the fallopian tubes that the sperm encounter the egg (if present), and fertilization happens when a sperm penetrates and fuses with the egg.

27. D — Fungi and Bacteria

Fungi and bacteria play a crucial role in nutrient cycling as they break down dead organic material, returning nutrients to the soil and enabling plant growth. Plants and predators do not perform decomposition functions. Plants contribute to the ecosystem by producing oxygen and serving as a food source.

28. C — Cerebrum, Olfactory lobes

The cerebrum is part of the central nervous system and plays a crucial role in sensory and motor processing. The olfactory lobes, also part of the central nervous system, are specifically involved in processing smell. Optic nerves are part of the peripheral nervous system, and while the medulla oblongata and cerebellum are central, they are more involved in autonomic functions and balance, respectively.

29. A — Ligament

Answer: Ligament Ligaments are the fibrous tissues that connect bones to other bones in joints. A twisted ankle typically involves stretching or tearing of ligaments within the joint.

30. C — Fruit Formation: Ovary matures into a fruit

Answer: Fruit Formation. After fertilization, the ovary of the flower matures into a fruit. This process encloses the seeds, giving rise to a fruit that aids in seed dispersal. Pollination, fertilization, and seed development are important steps in the reproductive cycle, but the ovary's transformation into fruit specifically denotes fruit formation.



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