Advanced Life Science Proficiency

Life Science · Answer Key · 10 Questions

1. Which enzyme is primarily responsible for the covalent joining of DNA fragments during replication and repair by catalyzing the formation of a phosphodiester bond?

A) DNA Helicase
B) DNA Ligase
C) DNA Polymerase III
D) Primase

2. In the context of the lac operon in E. coli, what molecule acts as the inducer that binds to the repressor protein to prevent it from binding to the operator?

A) Glucose
B) Lactose
C) Allolactose
D) cAMP

3. During the light-independent reactions (Calvin Cycle) of photosynthesis, which molecule is the primary CO_2 acceptor that reacts with CO_2 to form two molecules of 3-phosphoglycerate?

A) Ribulose-1,5-bisphosphate (RuBP)
B) Glyceraldehyde-3-phosphate (G3P)
C) Phosphoenolpyruvate (PEP)
D) Oxaloacetate

4. Which specialized cells in the vertebrate retina are responsible for high-acuity color vision and are densely concentrated in the fovea centralis?

A) Rod cells
B) Amacrine cells
C) Bipolar cells
D) Cone cells

5. What is the specific structural feature of the plasma membrane that is responsible for its 'fluid' property, according to the Fluid Mosaic Model?

A) Transmembrane protein density
B) Lateral diffusion of phospholipids
C) Cholesterol saturation levels
D) Oligosaccharide branching

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6. In population genetics, what is the term for the change in allele frequency in a gene pool due to a random, drastic reduction in population size?

A) Founder effect
B) Bottleneck effect
C) Assortative mating
D) Gene flow

7. Which hormonal pathway is primarily responsible for the regulation of blood calcium levels, specifically by stimulating osteoclast activity?

A) Adrenocorticotropic hormone (ACTH)
B) Parathyroid hormone (PTH)
C) Calcitonin
D) Aldosterone

8. What is the functional unit of a skeletal muscle fiber, defined as the segment between two Z-discs?

A) Myofibril
B) Sarcomere
C) Sarcoplasmic reticulum
D) T-tubule

9. During the process of oogenesis in humans, at what stage is the primary oocyte arrested from birth until puberty?

A) Prophase I
B) Metaphase I
C) Anaphase II
D) Prophase II

10. Which type of plant tissue is primarily responsible for the transport of water and dissolved minerals from the roots to the leaves?

A) Phloem
B) Parenchyma
C) Xylem
D) Collenchyma

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