

Advanced Genetic Principles

Genetics · Practice Test · 12 Questions

1. Which specific protein complex is responsible for the recognition of the promoter region during transcription initiation in eukaryotes?

- A) TATA-binding protein (TBP)
- B) DNA polymerase alpha
- C) RNA helicase
- D) Topoisomerase II

2. In the context of epigenetics, which enzyme family is primarily responsible for the removal of acetyl groups from histone tails, leading to chromatin condensation?

- A) Histone acetyltransferases (HATs)
- B) Histone deacetylases (HDACs)
- C) DNA methyltransferases (DNMTs)
- D) Histone methyltransferases (HMTs)

3. Which phenomenon describes the unequal expression of genes depending on whether they are inherited from the mother or the father?

- A) X-inactivation
- B) Genomic imprinting
- C) Genetic anticipation
- D) Codominance

4. During DNA replication, which enzyme is responsible for relieving torsional strain ahead of the replication fork by creating transient single-strand breaks?

- A) DNA ligase
- B) DNA primase
- C) Topoisomerase I
- D) DNA polymerase delta

5. What is the functional consequence of a transition mutation occurring within a protein-coding sequence that results in a redundant codon?

- A) Missense mutation
- B) Nonsense mutation
- C) Frameshift mutation
- D) Silent mutation

6. In the lac operon of E. coli, what is the direct role of allolactose?

- A) It acts as a corepressor to activate the repressor
- B) It functions as an inducer by binding to the lac repressor
- C) It catalyzes the conversion of lactose to glucose
- D) It binds to the operator to block RNA polymerase

7. Which structural motif is characterized by a zinc ion coordinated by cysteine and histidine residues, commonly found in DNA-binding proteins?

- A) Leucine zipper
- B) Helix-turn-helix
- C) Zinc finger
- D) Homeodomain

8. What is the primary role of the spliceosome in eukaryotic post-transcriptional processing?

- A) Addition of the 5' methylguanosine cap
- B) Polyadenylation of the 3' end
- C) Removal of introns and ligation of exons
- D) Translation of mRNA into polypeptide chains

9. Which statistical model is used to determine if observed phenotypic ratios in a cross deviate significantly from expected Mendelian ratios?

- A) Chi-square test
- B) Hardy-Weinberg equilibrium
- C) Standard deviation
- D) Linear regression

10. In human genetics, what describes the inheritance pattern where a mitochondrial DNA mutation is present in only some of the mitochondria within a single cell?

- A) Aneuploidy
- B) Heteroplasmy
- C) Polyploidy
- D) Translocation

11. Which process involves the exchange of genetic material between non-sister chromatids of homologous chromosomes during prophase I of meiosis?

- A) Independent assortment
- B) Chiasmata formation
- C) Terminalization
- D) Non-disjunction

12. What is the significance of the Shine-Dalgarno sequence in prokaryotic protein synthesis?

- A) It is the promoter binding site for RNA polymerase
- B) It terminates transcription
- C) It facilitates ribosome binding to the mRNA
- D) It guides the charging of tRNA