

一、單選題 (每題 3 分, 共 60 分) ※ 注意：請於試卷內之「選擇題作答區」依序作答。

- In garden peas, the allele for tall plants (D) is completely dominant to the allele for dwarf plants (d) and the allele for violet flower color (W) is completely dominant to the allele for white flower color (w). In a cross between a tall violet plant, with the genotype DDWw, and a dwarf white plant, what phenotypic ratio of the progeny would be expected from this cross?
(A) All tall violet
(B) 1 tall violet: 1 dwarf violet
(C) 1 tall violet: 1 tall white: 1 dwarf violet: 1 dwarf white
(D) 1 tall violet: 1 tall white
(E) All dwarf white
- Which of the following best explains how mutations in DNA can result in the expression of a new phenotype?
(A) A different polypeptide is produced.
(B) The polarity of tRNA becomes the opposite of that of DNA.
(C) Nucleic acids are methylated.
(D) The gene is now read in the 3° to 5° direction.
(E) Eukaryotes and prokaryotes have similar ribosomes.
- In a given population, 1 out of every 400 people has a cancer caused by a completely recessive allele, *b*. Assuming the population is in Hardy-Weinberg equilibrium, which of the following is the expected proportion of individuals who carry the *b* allele but are not expected to develop the cancer?
(A) 1/400 (B) 19/400 (C) 20/400
(D) 38/400 (E) 380/400
- RNA is thought to have played an important role in the evolution of life for which of the following reasons?
I. It occurred in great quantities on early Earth.
II. It can self-replicate via a complementary chain.
III. It can catalyze some cellular functions.
(A) I only (B) II only (C) III only
(D) I and II (E) II and III
- When DNA is extracted from cells of *E. coli* and analyzed for base composition, it is found that 38 percent of the bases are cytosine. What percentage of the bases are adenine?
(A) 12% (B) 24% (C) 38%
(D) 62% (E) 76%
- In vascular plants, DNA is contained in which of the following?
I. Nucleus
II. Chloroplast
III. Mitochondrion
(A) I only (B) II only (C) I and II only
(D) II and III only (E) I, II, and III

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7. When DNA replicates semiconservatively, which of the following is true of each daughter DNA molecule?
- (A) Both strands are newly synthesized.
 - (B) One strand is newly synthesized, whereas the other is a strand from the parent DNA molecule.
 - (C) Both strands are the original strands of the parent molecule.
 - (D) One strand has more AT-rich regions than the other strand has.
 - (E) The newly synthesized strands are more susceptible to melting and renaturation than the parental DNA strands are.
8. The cDNA fragment that includes the ricin gene is 5.7 kilobases. If the entire fragment codes for the ricin polypeptide, the approximate number of amino acids in the polypeptide would be
- (A) 17,100
 - (B) 5,700
 - (C) 2,500
 - (D) 1,900
 - (E) 570
9. Which of the following is a reason that geneticists use mitochondrial DNA (mtDNA) to study the relatedness of animal populations?
- (A) mtDNA mutates at a slower rate than nuclear DNA.
 - (B) mtDNA is passed from mother to child and is free from recombination that occurs between pairs of chromosomes.
 - (C) There are few single nucleotide polymorphisms in the hypervariable, noncoding regions.
 - (D) All mitochondrial proteins are coded for by mitochondrial genes.
 - (E) A large percentage of the mitochondrial genome codes for proteins, and thus the majority of retained mutations are neutral.
10. A DNA strand with the sequence 5' CGA TTG 3' would be complementary to the sequence
- (A) 5' GCU AAC 3'
 - (B) 5' GCT AAC 3'
 - (C) 5' GTT AGC 3'
 - (D) 5' CAA TCG 3'
 - (E) 5' CUU TCG 3'
11. The mechanisms contribute to genetic variation include
- I. random fertilization
 - II. Crossing over
 - III. Independent assortment of chromosomes
 - IV. Epigenetic control of gene expression
 - V. gene silencing by small RNAs
- (A) I, II, IV
 - (B) I, II, III
 - (C) I, II, III, IV
 - (D) I, II, IV, V
 - (E) I, II, III, IV, V
12. The production of different mature mRNAs from the same primary transcript by joining different combination of exons is called
- (A) DNA rearrangement
 - (B) DNA recombination
 - (C) Alternative splicing
 - (D) microRNA processing
 - (E) Ribozyme

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20. Which of the following is INCORRECT regarding the CRISPR mechanism
- (A) a region in many bacterial genomes that contains clustered regularly interspaced short palindromic repeats
 - (B) it confers immunity to viral infection
 - (C) it requires RNA molecules as the guide for targeting to specific sites
 - (D) it has been exploited for genome editing of higher organisms
 - (E) none of above

二、名詞解釋 (每題 4 分共 40 分) ※ 注意：請於試卷內之「非選擇題作答區」標明題號依序作答。

1. epigenetics
2. linkage
3. recessive allele
4. codominance
5. genomic imprinting
6. 5'UTR
7. operon
8. balancer chromosome
9. orthologs
10. nonsense mutation

試題隨卷繳回