

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

- Which of the following is *not* one of the assumptions of the Hardy-Weinberg law?
(A) The population is very large.
(B) Non-random mating occurs within the population.
(C) Mutations in the alleles do not occur.
(D) No migration occurs into or out of the population.
(E) The ability of all genotypes for survival and reproduction is the same.
- Colorblindness is a recessive sex-linked disease that is caused by a defective gene on the X-chromosome. If a mother who is a carrier for the trait mates with a normal sighted male, what percentage of their *daughters* will have the disease?
(A) 0% (B) 25% (C) 50% (D) 100% (E) cannot be determined
- Inversions can have an effect on the phenotype of the organism when
(A) the transcribed region of a gene spans one or more of the inversion's breakpoints.
(B) the inversion's breakpoints do not alter any of the inverted segments gene sequences.
(C) the inversion is pericentric.
(D) the inversion is paracentric.
(E) Inversions never affect phenotypes.
- Nondisjunction can occur at either the first or second division of meiosis. XYY individuals would most likely arise from nondisjunction at the _____ meiotic division in the _____.
(A) first, mother (B) second, mother (C) first, father
(D) second, father (E) More than one of the choices could give rise to XYY individuals.
- Which of the following statements is correct with respect to mitochondrial genes?
(A) They are transmitted, largely intact, from parent to offspring.
(B) Their inheritance shows Mendel's principle of segregation.
(C) Their inheritance shows Mendel's principle of independent assortment.
(D) A and B are correct. (E) A, B, and C are correct
- In a series of two-factor crosses, 30% recombination occurs between gene A and gene B, and 26% recombination between gene B and gene C. If the order of genes on the chromosome is A-B-C, how much recombination will be seen between A and C in a two-factor cross?
(A) 4% (B) 8% (C) 28% (D) 50% (E) 56%
- A genetic analysis of an unknown infectious agent reveals that it contains only the nucleotides G, A, U, and C in the proportion 30%, 35%, 15%, and 20%, respectively. Based on this information, this infectious agent is most likely a
(A) double-stranded DNA virus (B) double-stranded RNA virus (C) bacterium
(D) single-stranded DNA virus (E) single-stranded RNA virus

見背面

8. What is the molecular mechanism of genomic imprinting?
(A) Chromosome deletion (B) DNA methylation (C) Protein phosphorylation
(D) RNA methylation (E) DNA cross-linking
9. The nontemplate strand of a portion of a gene reads: 5'-TTCAGTGGTTCA. What is the sequence of the resulting transcript (RNA) for this portion?
(A) 5'-AAGUGACCAAGU (B) 5'-UGAACCAGUGAA (C) 5'-UUCACUGGUUCA
(D) 5'-ACUUGGUCACUU (E) 5'-TGAACCAGTGAA
10. The nucleotide sequence of a DNA reading frame is 5'GTA3'. A messenger RNA molecule with a complementary codon is transcribed from the DNA. In the process of protein synthesis, a transfer RNA pairs with the mRNA codon. What is the nucleotide sequence of the tRNA anticodon?
(A) 5'CAT3' (B) 5'CAU3' (C) 5'GUA3' (D) 5'UAC3' (E) 5'AUG3'
11. The polarity of DNA synthesis is
(A) 5'→3'. (B) 3'→5'. (C) 5'→2'. (D) 2'→5'. (E) 2'→3'
12. Which of the following phenotypic ratios show incomplete dominance?
(A) 2:1 (B) 3:1 (C) 1:2:1 (D) 1:1 (E) 4:1
13. Suppose the L and M genes are on the same chromosome but separated by 100 map units. What fraction of the progeny from the cross LM/lm x lm/lm would be Lm/lm?
(A) 10% (B) 25% (C) 50% (D) 75% (E) 100%
14. If a single DNA molecule is amplified by PCR, how many DNA molecules will there be after six cycles?
(A) 6 (B) 12 (C) 24 (D) 64 (E) 86
15. Robertsonian translocations result from which of the following?
(A) Breaks occur at or near the centromeres of two acrocentric chromosomes followed by the reciprocal exchange of broken parts.
(B) A part of one chromosome becomes attached to a non-homologous chromosome.
(C) Unequal crossing over occurs during meiosis.
(D) There is fusion of two small chromosomes end-to-end such that a double centromere occurs.
(E) None of above
16. How do negative regulators such as the lac repressor prevent RNA polymerase from initiating transcription?
(A) by blocking passage of the polymerase through the operator
(B) by forming a loop in the operator that restricts the passage of the polymerase
(C) by physically blocking the DNA binding site of RNA polymerase
(D) by binding to the polymerase, thus preventing its binding to DNA
(E) by slowing down the RNA polymerase.

17. Mutation of homeotic cluster genes often results in which of the following developmental defects in *Drosophila* ?
- (A) Absence of a group of contiguous segments
 - (B) Transformation of one segment into another
 - (C) Polarity defects in every segment along the anterior-posterior axis
 - (D) Tumor formation in imaginal discs
 - (E) Absence of every other segment along the anterior-posterior axial
18. When bacteria produce mammalian proteins, cDNA is used rather than genomic DNA. Which of the following is the best explanation?
- (A) It is easier to clone cDNA than genomic DNA of comparable size.
 - (B) It is easier to clone RNA than DNA.
 - (C) It is not possible to clone the entire coding region of the gene.
 - (D) Most eukaryotic genes have introns that cannot be removed in bacteria.
 - (E) Most eukaryotic gene promoters do not function in bacteria.
19. Consider the average in vivo turnover rates for proteins, DNA, and mRNA. Which of the following orders best describes the turnover rate from fastest (shortest average lifetime) to slowest (longest average lifetime)?
- (A) mRNA > DNA > proteins
 - (B) mRNA > proteins > DNA
 - (C) Proteins > mRNA > DNA
 - (D) Proteins > DNA > mRNA
 - (E) DNA > mRNA > proteins
20. Which of the following most accurately describes a retrotransposon?
- (A) A DNA sequence that can move from one site in the genome to another without replicating
 - (B) A DNA sequence that can be deleted from the genome without consequence
 - (C) A DNA sequence that replicates via an RNA intermediate
 - (D) A DNA sequence that replicates via a protein intermediate
 - (E) A DNA sequence that causes base-substitution mutations at some other site on the chromosome

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

1. Allele
2. Homologous recombination
3. SNP (single nucleotide polymorphism)
4. 3'UTR
5. Oncogene
6. Syntenic block
7. Genome
8. Aneuploidy
9. Telomerase
10. Alternative splicing

試題隨卷繳回