

※ 考生請注意：本試題不可使用計算機。 請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

一、SIMPLE-CHOICE QUESTIONS 單選題 (two points for each question.每題 2 分)(38%)

(以 A、B、C、D、E 五種選項作答，其餘一律不計分)

1. Which of the following can classified as a dehydration reaction?
 - A) phosphodiester bond formation in RNA
 - B) phosphodiester bond formation in rRNA
 - C) peptide bond formation
 - D) phosphodiester bond formation in mRNA
 - E) all of the choices are correct.

2. Homologous genes are best described as genes that
 - A) have identical sequences.
 - B) have a common ancestral gene.
 - C) have similar functions.
 - D) are on the same chromosome.
 - E) are on homologous chromosomes.

3. Which of the following is not considered part of a transcriptional unit?
 - A) 5' UTR
 - B) 3' UTR
 - C) introns
 - D) exons
 - E) none of the choices are correct

4. Looking at the binding of proteins to DNA in terms of entropy, it appears that
 - A) the level of entropy decreases in monomeric proteins promoting binding to DNA.
 - B) the DNA-protein complex is more ordered than the DNA or protein alone.
 - C) binding of two protein subunits, independently of each other, causes an increase in entropy.
 - D) the level of entropy decreases in monomeric proteins promoting binding to DNA and the DNA-protein complex is more ordered than the DNA or protein alone are correct.
 - E) the DNA-protein complex is more ordered than the DNA or protein alone and binding of two protein subunits, independently of each other, causes an increase in entropy are correct.

5. During chromatin remodeling, which of the following is acetylated to loosen its contact with the DNA?
- A) DNA
 - B) nucleosome
 - C) histone proteins
 - D) HO gene
 - E) histone acetyltransferase
6. Which of the following is a characteristic of double-stranded DNA?
- A) 2 nanometers in width
 - B) 10 base pairs per turn
 - C) 0.34 nanometers per basepair
 - D) B and C
 - E) A, B and C
7. Which of the following is not a technique that can be used to study protein-protein interactions?
- A) 2-D gel electrophoresis
 - B) protein microarrays
 - C) immunoaffinity chromatography
 - D) phage display
 - E) yeast two-hybrid analysis
8. A new mutant cell line was accidentally created in the lab. This mutant was found to be deficient in the enzyme aminacyl-tRNA synthetase. Which of the following would most likely be observed in this cell line?
- A) No tRNA molecules would be present
 - B) tRNA molecules would contain no anticodons
 - C) Most tRNA molecules would not be able to attach to amino acids
 - D) Protein synthesis would increase
 - E) None of the choices are correct
9. The easiest way to analyze protein molecular weight and subunits is SDS-Gel electrophoresis. which description is correct?
- A) the protein analyzed still contain secondary structure
 - B) can use reducing agent, like b-mercaptoethanol to break the S-S bond
 - C) the positive charge of carried by SDS bound to the protein enable them to migrate on the gel
 - D) SDS is consisting of a 12-carbon tail attached to a phosphate group, giving the material the amphiphilic properties
 - E) it can be used to analyze different subunits of the same molecular weights

10. Biosynthesis of cytosolic protein in Eukaryotes is a complex event. During elongation of protein synthesis, the growing polypeptide chain is covalently attached to the ___ in the P-site in the ribosomal –RNA complex. The new amino acid will be brought to the ___ site with the matched anticodon for further peptide bond formation. These synthesis processes will be terminated when ribosome recognizes _____ codon.

- A) tRNA, A, ATG
- B) tRNA, A, UAA
- C) tRNA, E, ATG
- D) rRNA, E, UAA
- E) None of the choices are correct

11. A plasmid is a DNA molecule used in making the recombinant DNA. Which statement is “NOT” correct

- A) It is derived from yeast.
- B) The structure is a closed circle.
- C) With this, plant DNA can be doubled quickly.
- D) It can be used to store any desired genes from different organisms.
- E) All of the choices are correct

12. In Eucaryotic, DNA are packaged to a high degree of structure, chromosome. Which is the correct packing order?

- A) histone --> core DNA -->nucleosomes-->fiber-->chromatin-->chromosome
- B) core DNA-->histone-->nucleosomes-->fiber-->chromatin-->chromosome
- C) core DNA--> nucleosomes --> histone --> chromatin --> fiber -->chromosome
- D) core DNA-->histone--> fiber --> nucleosomes -->chromatin-->chromosome

13. Which is the correct feature of Eukaryotic genome?

- A) There is a correlation between the quantity of DNA and the complexity of the organism.
- B) Most DNA in mammalian or plant is single-copy with little duplicate sequences.
- C) One reason for the large size of eukaryotic genome is that most genes contain introns, which may serve as loci for alternative splicing.
- D) In many cases, a gene family exists to code for different variants of the same type of proteins that may be evolved from mutation of different genes.
- E) None of the choices are correct

14. Which statement about epigenetic mechanisms of gene regulation is “NOT” true?
- A) the definition is that gene expression is regulated by changes in the genome but not mutation in DNA sequences.
 - B) The effect is non-heritable and reversible
 - C) it can be induced by repeated DNA sequences or chromosomal location.
 - D) Cytosine methylation of DNA is one the classic epigenetic changes in gene expression
 - E) All of the choices are correct
15. When a DNA molecule is described as replicating bidirectionally, that means that it has two:
- A) chains.
 - B) independently replicating segment.
 - C) origins.
 - D) replication forks.
 - E) termination points.
16. Which mechanism is used to repair a thymidine dimer in DNA?
- A) mismatch repair
 - B) base-excision repair
 - C) nucleotide-excision repair
 - D) direct repair
 - E) more than one is used for this type of lesion
17. The chromosomal region that is the point of attachment of the mitotic spindle is the:
- A) centromere.
 - B) endomere.
 - C) exon.
 - D) intron.
 - E) telomere
18. Which of the following statements correctly describes promoters in *E. coli*?
- A) A promoter may be present on either side of a gene or in the middle of it.
 - B) All promoters have the same sequence that is recognized by RNA polymerase holoenzyme.
 - C) Every promoter has a different sequence, with little or no resemblance to other promoters.
 - D) Many promoters are similar and resemble a consensus sequence, which has the highest affinity for RNA polymerase holoenzyme.
 - E) Promoters are not essential for gene transcription, but can increase its rate by two- to three-fold.

19. Gene silencing by RNA interference acts by _____ of the target gene.

- A) inhibiting transcription
- B) inhibiting translation
- C) inhibiting splicing
- D) degradation of the mRNA
- E) inhibiting polyadenylation

二、MATCHING 配合題 (Match the protein or structural feature on the left with one appropriate description on the right (10%))

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| (請
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作
答) | 1. ___ activator | (a) a positive regulator |
| | 2. ___ helix-turn-helix | (b) a negative regulator |
| | 3. ___ leucine zipper | (c) facilitates transcription only when bound to a signal molecule |
| | 4. ___ repressor | (d) a DNA-binding structural motif found in many prokaryotic regulatory proteins |
| | 5. ___ zinc finger | (e) a structural feature involved in protein-protein interactions between some regulatory protein monomers |
- (f) a protein that dissociates from DNA when bound to a signal molecule
- (g) a DNA-binding structural motif found in many eukaryotic regulatory proteins

三、EXPLAIN 解釋名詞 (Three points for each question.每題 3 分)(15%)

1. T-DNA
2. Chaperone
3. Reverse genetics
4. Transposable elements
5. *Agrobacterium tumefaciens*

四、SHORT ESSAY 問答題 (37%)

1. A diploid organism with a 60,000-kb haploid genome contains 23% G residues. Calculate the number base (bp) of A, C, G, and T residues in the DNA of each cell in this organism. (4%)
2. Supposed that flower size and color are controlled by B and R gene respectively, B and R are the dominant factors showing Big and Red flowers, respectively. And b and r represent the recessive factors showing small and white flowers, respectively. if we make a hybrid cross from a male parent, carrying "BBRR" and a female parent, carrying "bbr". Please deduce the genotype and phenotypes of the F1 and F2 populations and corresponding ratios. Please provide explanations. (5%)
3. DNA paternity test is the use of DNA fingerprinting to determine whether a man/woman could be the biological father/mother of a child. Please explain the basis of DNA paternity test and describe the procedure of the test? (8%)
4. How the blue/white screening for recombinant plasmids work using vector pUC18 containing a multiple cloning site within a *lacZ* gene? (5%)
5. Briefly describe the principle of polymerase chain reaction (PCR) for amplifying a given stretch of DNA. (5%)
6. What is the difference between reverse transcriptase PCR (RT-PCR) and standard PCR? For what purpose would you use RT-PCR? (5%)
7. Please describe the basis of Agrobacterium-mediated gene transformation in plant. (5%)