

※ 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、 Choose the best answer (45 分, 每題 3 分)

- (1) Which of these statements about nucleic acids is *false*?
- A) Mitochondria and chloroplasts contain DNA.
  - B) Plasmids are genes that encode plasma proteins in mammals.
  - C) The chromosome of *E. coli* is a closed-circular, double-helical DNA.
  - D) The DNA of viruses is usually much longer than the viral particle itself.
  - E) The genome of many plant viruses is RNA.
- (2) Introns:
- A) are frequently present in prokaryotic genes but are rare in eukaryotic genes.
  - B) are spliced out before transcription.
  - C) are translated but not transcribed.
  - D) can occur many times within a single gene.
  - E) encode unusual amino acids in proteins.
- (3) Topoisomerases can:
- A) change the linking number (*Lk*) of a DNA molecule.
  - B) change the number of base pairs in a DNA molecule.
  - C) change the number of nucleotides in a DNA molecule.
  - D) convert D isomers of nucleotides to L isomers.
  - E) interconvert DNA and RNA.
- (4) Histones are \_\_\_\_\_ that are usually associated with \_\_\_\_\_.
- A) acidic proteins; DNA
  - B) acidic proteins; RNA
  - C) basic proteins; DNA
  - D) basic proteins; RNA
  - E) coenzymes derived from histidine; enzymes
- (5) A condensed eukaryotic chromosome is known to be associated with all of the following proteins, *except* for:
- A) core histones H2A, H2B, H3, and H4.
  - B) histone H1
  - C) SMC proteins
  - D) topoisomerase I
  - E) topoisomerase II
- (6) 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
- (7) Which of the following is a DNA sequence?  
A) Coactivator  
B) Corepressor  
C) Enhancer  
D) Inducer  
E) Transactivator
- (8) Which one of the following statements about eukaryotic gene regulation is correct?  
A) Large polycistronic transcripts are common.  
B) Most regulation is positive, involving activators rather than repressors.  
C) Transcription and translation are mechanistically coupled.  
D) Transcription does not involve promoters.  
E) Transcription occurs without major changes in chromosomal organization.
- (9) The 5' → 3' exonuclease activity of *E. coli* DNA polymerase I is involved in:  
A) formation of a nick at the DNA replication origin.  
B) formation of Okazaki fragments.  
C) proofreading of the replication process.  
D) removal of RNA primers by nick translation.  
E) sealing of nicks by ligase action.
- (10) 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.
- (11) Which one of the following is *not* true of the mRNA for MADS-box genes?  
A) Exons are used for polypeptide synthesis.  
B) Introns are complementary to their adjacent exons and will form hybrids with them.  
C) The mature mRNA is substantially shorter than the corresponding region on the DNA.  
D) The mRNA is originally synthesized in the nucleus, but ends up in the cytoplasm.  
E) The splicing that yields a mature mRNA occurs at very specific sites in the RNA primary transcript.
- (12) Compared with DNA polymerase, reverse transcriptase:  
A) does not require a primer to initiate synthesis.  
B) introduces no errors into genetic material because it synthesizes RNA, not DNA.  
C) makes fewer errors in synthesizing a complementary polynucleotide.  
D) makes more errors because it lacks the 3' → 5' proofreading exonuclease activity.  
E) synthesizes complementary strands in the opposite direction from 3' → 5'.

(13) Which of these polymerases does not require a template?

- A) RNA pol I
- B) RNA pol II
- C) Reverse transcriptase
- D) Polyadenylate polymerase
- E) RNA replicase

(14) The signal sequences that direct proteins to the nucleus are:

- A) always at the amino terminus of the targeted protein.
- B) cleaved after the protein arrives in the nucleus.
- C) glycosyl moieties containing mannose 6-phosphate residues.
- D) not located at the ends of the peptide, but in its interior.
- E) the same as those that direct certain proteins to lysosomes.

(15) Which of the following is (are) true for protein synthesis in eukaryotes?

- A) All proteins are initially synthesized with methionine at their C-terminus.
- B) All proteins are initially synthesized with methionine at their N-terminus.
- C) All proteins are initially synthesized with tryptophan at their C-terminus.
- D) All proteins are initially synthesized with a multiple of 3 amino acids in their sequence.
- E) None of the above.

二、EXPLAIN 解釋名詞 (five points for each question. 每題 5 分) (40%)

1. CRISPR/Cas
2. microRNA
3. Bioinformatics
4. transcriptome
5. *cis*-acting element
6. Yeast two-hybrid
7. vernalization
8. nucleosome

## 三、MATCHING QUESTIONS 配合題

(three points for each question. 每題 3 分) (15%)

Please select a suitable enzyme which is required for the technique or mechanism.

_____ Q1. PCR	(A) phosphatase
_____ Q2. cutting plasmid	(B) methyltransferases
_____ Q3. transcription	(C) restriction enzyme
_____ Q4. DNA repair	(D) ligase
_____ Q5. epigenetic mechanism	(E) DNA polymerase
	(F) RNA polymerase
	(G) protease