

※ 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、名詞解釋: (22%，請解釋清楚，不要只是英翻中)

- (1)、RNAi (4%)
- (2)、ariat structure (4%)
- (3)、Transposable elements (4%)
- (4)、Okazaki Fragments (4%)
- (5)、microRNA (3%)
- (6)、ribosome complex (3%)

二、多重選擇題: (複選) (3 points for each question, 21%)

Q1. Which of the following are correct about DNA replication?

- (A). DNA replication adopts a conservative model
- (B). DNA replication adopts a semiconservative model
- (C) DNA replication adopts a dispersive model.
- (D) Helicase and energy are required to unwind the double helix
- (E) DNA ligases are required to join nicked DNA fragments

Q2. Which of the following are NOT correct about the eukaryotic DNA replication?

- (A) The replication initiation is started from the origin
- (B) Requires single origin of replication
- (C) Requires DNA primer
- (D) Linear eukaryotic chromosomes require telomerase to form their ends.
- (E) All of the above

Q3. Which of the following are essential components of Bacterial RNA polymerase Holoenzyme?

- (A) Recombinase
- (B) Transposase
- (C) Endonuclease
- (D) Sigma factor
- (E) A core enzyme

Q4. Which of the following are required for RNA polymerase to synthesize RNA?

- (A) DNA template
- (B) rRNA
- (C) tRNA
- (D) mRNA
- (E) Four nucleoside triphosphates

Q5. Which of the following are NOT involved in the transcriptional initiation?

- (A) Promoter
- (B) TATA box
- (C) CAAT box
- (D) Okazaki fragments
- (E) Transcription factors

Q6. Telomerase plays an important role in solving the end-replication problem. Which of the following are correct about telomerase functions?

- (A) A strand specific DNA 5'→3' exonuclease removes nucleotides to generate an overhang.
- (B) A strand specific DNA 3'→5' exonuclease removes nucleotides to generate an overhang
- (C) Telomerase extends the 3' overhang.
- (D) Telomerase extends the 5' overhang.
- (E) Newly synthesized region serves as a template for standard replication, restoring the 5' end.

Q7. RNA polymerase produces RNA that functionally is either coding RNA for protein or non-coding RNA for the different functional types of RNA genes. Which of the following are NOT included in the non-coding RNA types?

- (A) Catalytic RNA (Ribozyme)
- (B) tRNA
- (C) siRNA
- (D) miRNA
- (E) mRNA

三、選擇題（單選題）(3 points for each question, 57%)

DNA Polymerase Chain Reaction (PCR) is a technique used in molecular biology to amplify a single copy or a few copies of a segment of DNA across several orders of magnitude that generates thousands to millions of copies of a particular DNA sequence. Please answer the following Q8 to Q10.

Q8. Which one of the following is NOT required in a typical PCR reaction?

- (A) dNTPs
- (B) a thermostable DNA polymerase
- (C) a buffer solution with bivalent cations
- (D) ATP
- (E) primers

Q9. A PCR reaction could amplify a DNA fragment through repeating the steps in which of the following sequence?

- (A) denaturing-annealing-extension.
- (B) annealing-extension-denaturing.
- (C) denaturing-polymerization-extension.
- (D) annealing-denaturing-extension.
- (E) None of the above

Q10. Which of the following descriptions about each step of a PCR reaction is correct?

- (A) The purpose of denaturing is to denature the DNA polymerase.
- (B) The annealing temperature is higher than the denaturing temperature.
- (C) The annealing step is to let the DNA polymerase bind the DNA template.
- (D) The denaturing step causes the double-stranded DNA melting, yielding two single-stranded DNA molecules.
- (E) None of the above

Q11. In a eukaryotic cell, which of the following molecules themselves carry the genetic information from the nucleus to the cytoplasm?

- (A) Proteins
- (B) Lipids
- (C) DNA
- (D) mRNA
- (E) Salts

Q12. For the DNA strand 5'-AGTAATCCAT-3', the correct complementary DNA strand is?

- (A) 5'-TCATTAGGTA-3'
- (B) 5'-GAATTACCTA-3'
- (C) 5'-ATGGATTACT-3'
- (D) 5'-AGTAATCCAT-3'
- (E) 5'-TACCTAATGA-3'

Q13. Which of the following is not part of the *lac* operon of *E. coli*?

- (A) Genes for expressing enzymes of lactose metabolism
 (B) Genes for the repressor, a regulatory protein
 (C) The operator, the repressor-binding site
 (D) Genes for RNA polymerase polymerase-binding site
 (E) A promoter, the RNA

Q14. Why do pre-mRNAs get smaller during RNA processing?

- (A) Capping
 (B) Reverse transcription
 (C) Removal of poly A tails
 (D) Cleavage of polycistronic mRNA
 (E) Splicing

Q15. Which of the following features could NOT be found in heterogeneous nuclear RNA (hnRNA)?

- (A) Polycistronic coding
 (B) Intron
 (C) Polyadenylation at 3'-end
 (D) 5'-cap structure
 (E) U nucleotides

Q16. Which of the following is the name of human genetic disorder resulting from defects in nucleotide excision repair?

- (A) Diabetes
 (B) Hereditary nonpolyposis colorectal cancer (HNPCC)
 (C) Xeroderma pigmentosum (XP)
 (D) Lung cancer
 (E) Breast cancer

Q17. What is the name of the DNA repair system in *E. coli* in which dual incisions are made in the damaged part of the DNA double helix, and a 12-13 base segment is removed and replaced with new DNA?

- (A) Base excision repair
 (B) Nucleotide excision repair
 (C) Mismatch repair
 (D) AP site repair
 (E) Splicing

Q18. Amino acid-coding regions within eukaryotic genes may be interrupted by _____ regions.

- (A) noncoding
 (B) long terminal repeat
 (C) split gene
 (D) Enhancer
 (E) none of the above

Q19. One common type of RNA editing in human cells is due to a change from:

- (A) I to A
 (B) G to I
 (C) U to C
 (D) C to U
 (E) A to G

Q20. Eukaryotic translation initiation proceeds through a _____ mechanism.

- (A) scanning
 (B) Recombination
 (C) Repetitive
 (D) looping

Q21. The majority of defects in human genes are:

- (A) large deletions.
 (B) missense or nonsense mutations.
 (C) large rearrangements.
 (D) mutations affecting splicing.
 (E) small deletions.

Q22 Which of the following is generally not a way that antisense RNA might inhibit gene expression?

- (A) It might prevent translation.
 (B) It might affect RNA processing.
 (C) It might affect stability of the protein product.
 (D) It might prevent transcription.
 (E) All of these are ways that antisense RNA might inhibit gene expression.

Q23. Which statement best describes the relationship between methylation and gene activity?

- (A) DNA methylation is generally associated with transcriptional inactivity.
- (B) DNA methylation is generally associated with translational inactivity.
- (C) DNA methylation is generally associated with transcriptional activity.
- (D) Histone methylation is generally associated with transcriptional inactivity.
- (E) Histone methylation is generally associated with transcriptional activity.

Q24. The wobble hypothesis states that:

- (A) codon-anticodon pairing must only follow the standard base-pairing rules at the first two codon positions.
- (B) some mutations introduce termination codons.
- (C) most amino acids have more than one codon representing them.
- (D) an mRNA may encode more than one polypeptide, and the ribosome may “wobble” or begin at alternate start codons.
- (E) mutations are less likely to occur at the third base of the codon.

Q25. The ribosomal E site:

- (A) binds aminoacyl-tRNA.
- (B) binds the peptidyl-tRNA.
- (C) binds the Shine-Dalgarno sequence.
- (D) transiently binds deacylated tRNA.
- (E) binds the mRNA start codon.

Q26. The stem-loop structure at the 3' end of a bacterial mRNA functions primarily in:

- (A) termination of translation.
- (B) regulating the frequency of translation.
- (C) termination of transcription.
- (D) mRNA stability.
- (E) mRNA transport.