

※ 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)、選擇題，每題 4 分，共 60 分，所有考題務必在答案卷上作答。

1. Which of the following tripeptides would be most likely to be soluble in a hydrophilic solution like phosphate buffer?
  - A) N - phenylalanine- alanine-glycine-C
  - B) N - leucine - alanine - lysine - C
  - C) N - proline - phenylalanine - leucine - C
  - D) N - arginine - lysine - proline - C
  - E) N - glutamate - aspartate - glycine - C
2. What is the maximum number of 100 amino acid long polypeptides that could be made?
  - A) 20
  - B)  $20^{101}$
  - C)  $100^{20}$
  - D)  $20^{100}$
  - E) 2,000
3. What is largely responsible for the negative charge on many oligosaccharide chains?
  - A) glucose
  - B) galactose
  - C) glutamic acid
  - D) sialic acid
  - E) aspartic acid
4. The temperature at which a lipid bilayer shifts from a fluid state to a crystalline gel is called the \_\_\_\_\_.
  - A) pH optimum
  - B) transition temperature
  - C) gelation temperature
  - D) transition series
  - E) temperature optimum
5. You are studying two strands of DNA. They have exactly the same length, but the first one has a very high G + C/A + T ratio of 3.4. The second DNA strand has a more moderate G + C/A + T ratio of 2.3. Which of the two strands will have the highest melting temperature and why?
  - A) the first strand because it contains fewer H bonds

- B) the second strand because it contains fewer H bonds  
C) neither since their melting temperatures are the same  
D) the first strand because it contains more H bonds  
E) the second strand because it contains more H bonds
6. Human topoisomerase II is a target for numerous drugs like etoposide and doxorubicin that are used to kill rapidly dividing cancer cells. How do the drugs work?
- A) The drugs bind to the enzyme and keep cleaved DNA strands from being resealed.  
B) The drugs bind cofactors needed by the enzyme.  
C) The drugs inhibit the Krebs cycle in cancer cells which indirectly affects human topoisomerase II.  
D) The drugs cleave topoisomerase II between amino acids 44 and 45 in the polypeptide chain.  
E) The drugs denature the enzyme.
7. What feature of mature mRNAs is thought to protect them from premature degradation by cellular exonucleases?
- A) exons  
B) introns  
C) consensus sequences  
D) poly(A) tail  
E) 5'-methylguanosine cap
8. Why would changes in the genes for transcription factors be expected to generate major phenotypic differences?
- A) They can affect the expression of large numbers of other genes.  
B) Their gene products normally denature more rapidly than other gene products.  
C) Their gene products are remarkably stable.  
D) They can affect the expression of small numbers of other genes.  
E) They are extremely powerful genes.
9. What is the major determinant of RNA folding?
- A) formation of complementary base pair regions  
B) ionic bonds  
C) hydrophobic interactions  
D) van der Waals forces  
E) hydrophobic interactions
10. What residues in proteins are common sites of phosphorylation?

- A) Serine, Histidine, Tyrosine
  - B) Serine, Histidine, Threonine
  - C) Serine, Threonine, Tyrosine
  - D) Serine, Lysine, Aspartate
  - E) all of the above
11. Which of the following is a DNA nucleotide?
- A) a phosphate group, adenine and ribose
  - B) a phosphate group, guanine and deoxyribose
  - C) cytosine and ribose
  - D) thymine and deoxyribose
  - E) a phosphate group and adenine
12. Which of the following is a RNA nucleoside?
- A) a phosphate group, adenine and ribose
  - B) a phosphate group, guanine and deoxyribose
  - C) thymine and deoxyribose
  - D) cytosine and ribose
  - E) a phosphate group and adenine
13. Which of the following is **not** required for protein synthesis?
- A) All of the various tRNAs with their attached amino acids
  - B) Ribosomes
  - C) mRNA
  - D) GTP
  - E) None of the above
14. What is the name of the enzyme that forms the peptide bond and of what is the enzyme composed?
- A) peptidase, RNA
  - B) peptidase, protein
  - C) peptidyl transferase, RNA
  - D) peptidyl transferase, protein
  - E) peptidyl transferase, polypeptide
15. You isolate DNA from a particular organism and analyze it. The amount of adenine was 6 mmoles and the A+T/G+C ratio is 4.0. How much guanine should be in the sample?
- A) 1.5 mmoles

- B) 3 mmoles
- C) 4 mmoles
- D) 6 mmoles
- E) 12 mmoles

(二)、解釋下列名詞，每題 5 分，共 30 分，所有考題務必在答案卷上作答。

1. Frameshift mutations
2. RNA interference (RNAi)
3. DNA methylation
4. Posttranslational modification
5. Apoptosis
6. Micro RNAs (miRNAs)

(三)、回答下列問題，務必在答案卷上作答，共 10 分。

1. What gene is unique to retroviruses? Why is the protein encoded by this gene absolutely necessary for maintaining the retroviral life cycle, but not that of other viruses? This protein plays essential roles in molecular cloning. What is the application?