

編號： 538 系所：□腔醫學研究所甲組

科目：生物化學

本試題是否可以使用計算機：可使用，不可使用（請命題老師勾選）

1. Briefly describe the following terms (40%).
  - a. Signal sequence
  - b. Telomerase
  - c. MicroRNA
  - d. Alternate splicing
  - e. Polymerase chain reaction
  - f. Reading frame
  - g. Competitive inhibitor
  - h. Disulfide bridge
  
2. One strand of a double-helical DNA has the sequence as shown below. Write the base sequence of the complementary strand. What special type of sequence is contained in this DNA segment? Does the double-stranded DNA have the potential to form any alternative structures? (10%)  
5'-GCGCAATATTTCTCAAAATATTGCGC-3'
  
3. Describe the basic principles how it is possible to identify proteins by mass spectrometry. (10%)
  
4. In samples of DNA isolated from two unidentified species of bacteria, X and Y, adenine makes up 32% and 17%, respectively, of the total bases. What relative proportions of adenine, guanine, thymine, and cytosine would you expect to find in the two DNA samples? One of these species was isolated from a hot spring (65°C). Suggest which species is the thermophilic bacterium. What is the basis for your answer? (10%)
  
5. A secretory enzyme isolated from rat liver has 192 amino acid residues and is coded for by a gene with 1,440 bp. Explain the relationship between the number of amino acid residues in the enzyme and the number of nucleotide pairs in its gene. (10%)

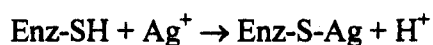
(背面仍有題目,請繼續作答)

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6. The active site of lysozyme contains two amino acid residues essential for catalysis: Glu<sup>35</sup> and Asp<sup>52</sup>. The pKa values of the carboxyl side chains of these residues are 5.9 and 4.5, respectively. What is the ionization state (protonated or deprotonated) of each residue at pH 5.2, the pH optimum of lysozyme? (10%)
7. Many enzymes are inhibited irreversibly by heavy metal ions such as Hg<sup>2+</sup>, Cu<sup>2+</sup>, or Ag<sup>+</sup>, which can react with essential sulfhydryl groups to form mercaptides:



The affinity of Ag<sup>+</sup> for sulfhydryl groups is so great that Ag<sup>+</sup> can be used to titrate -SH groups quantitatively. To 10.0 mL of a solution containing 1.0 mg/mL of a pure enzyme, an investigator added just enough AgNO<sub>3</sub> to completely inactivate the enzyme. A total of 0.25 μmol of AgNO<sub>3</sub> was required. Calculate the minimum molecular weight of the enzyme. Why does the value obtained in this way give only the *minimum* molecular weight? (10%)