＊所有考題務必在答案卷上作答，在考題卷上作答者無效
一. 選擇題（1% each）

1. How does ionic strength influence protein solubility?

   A. The higher the ionic strength, the greater the solubility.
   B. The higher the ionic strength, the lower the solubility.
   C. Under constant ionic strength, protein solubility is constant regardless of pH.
   D. At very high salt concentration, the solubility of a protein decreases.
   E. At low salt concentration, the solubility decreases when ionic strength increases.

2. Which of the following amino acids can exist as four optically active isomers?

   A. Asparagine
   B. Arginine
   C. Cystine
   D. Threonine
   E. Proline

3. Which of the following can be used for the determination of the N-terminal residues of a protein?

   A. Ninhydrin
   B. Dansyl chloride
   C. Fluorescamine
   D. Cyanogen bromide
   E. hydrazine

4. To determine the amino acid composition of a protein, the protein is first hydrolyzed by 6N HCl, followed by the separation of the amino acid mixture using

   A. gel-filtration.
   B. cation-exchange chromatography.
   C. anion-exchange chromatography.
   D. affinity chromatography.
   E. SDS-gel electrophoresis.

5. Paper electrophoresis at pH 6.0 was carried out on a mixture of glycine, aspartic acid, glutamine, lysine and tyrosine. Given the pKa values of the amino acids as follows:

   A. Glycine: 2.3, 9.6
   B. Aspartic acid: 2.1, 3.9, 9.8
   C. Glutamine: 2.2, 9.1
   D. Lysine: 2.2, 9.0, 10.0
   E. Tyrosine: 2.2, 9.1, 10.1

   Which of the above amino acids moved fastest toward the cathode?

For questions 6 to 8

   A. α-helix
   B. β-pleated sheet
   C. random coil
   D. all of the above
   E. none of the above

6. is produced by procedures that denature proteins.

7. is formed by hydrogen bonding between the peptide bonds on adjacent chains.

8. is maintained by hydrogen bonds parallel to the axis of the protein.

9. When protein subunits combine to form a quarternary structure, all of the following interactions may arise EXCEPT

   A. peptide bond formation.
   B. hydrophobic interaction.
   C. electrostatic bonding.
   D. van der Waals forces.
   E. hydrogen bonding.

10. Which of the following has quarternary structure?

    A. Insulin
    B. Myoglobin
    C. Hemoglobin
    D. Cytochrome c
    E. None of the above

二·選擇題 (2% each)

11. Which statement about sickel cell anemia is INCORRECT?

    A. Sickel cell hemoglobin S (HbS) migrates toward the positively charged electrode at a slightly faster rate than normal hemoglobin A (HbA).
    B. HbS differs from HbA in only one peptide spot on their tryptic peptide maps.
    C. HbS has only one amino acid change in their chain sequence when compared with HbA.
    D. HbS contains two valine residues in place of the normal glutamic acid residues which creates "sticky" contact points to form the long aggregates responsible for sickling of the red blood cells.
    E. The hemoglobin content of the blood of such patients is only about half the normal value of 15 to 16 g per 100 ml.

12. Which of the following statements is INCORRECT?

When blood passes through the capillaries of the tissues, the release of oxygen from oxyhemoglobin is facilitated by

    A. an elevation in the partial pressure of CO_2.
    B. a decrease in the partial pressure of CO_2.
    C. the binding of 2,3-bisphosphoglycerate to hemoglobin.
    D. an increase of hydrogen ion concentration.
    E. a decrease in pH value.

(三) 問答題.

13. What is the pH of the buffer mixture containing 0.5 M sodium acetate and 1 M acetic acid? (pKa of acetic acid is 4.76; log 2 = 0.3). (2%)

14. The amino group of alanine, which has a pKa of 9.5, can exist in either the protonated form or the free base form. What is the pH at which 99% of the alanine has its amino group in the free base form? (2%)

15. The pKa values for lysine are, 2.2, 9.0 and 10.0 (side chain). The pKa values for glutamic acid are 2.2, 4.2 (side chain) and 9.7. White the predominant ionic structure of the dipeptide Glu-Lys at pH 7.0. (2%)

16. Describe the structural differences between cellulose and starch. (2%)

17. Give two examples of glycosaminoglycans. (2%)

18. The fatty acid composition of bacterial membranes can be changed by the conditions under which the bacteria are grown. For example, if the bacteria are grown at lower than normal temperatures, the observed amounts of unsaturated fatty acids (relative to the saturated fatty acid content) are above normal. Conversely, if the bacteria are grown at higher than normal temperatures, the observed amounts of unsaturated fatty acids in the membrane lipids (relative to the saturated fatty acids) are below normal. Explain why? (2%)

19. If 16% of the body mass of a 60-kg adult consists of triacylglycerols, calculate the total available fuel reserve in kilo-calories in the form of triacylglycerols. (2%)

20. Stearic acid labeled with ^{14}C in carbon atom 7 is oxidized under conditions in which the citric acid cycle is operating. What will the location of ^{14}C be in (a) acetyl-CoA, (b) citric acid, and (c) butyryl-CoA? Assume only one turn of the citric acid cycle. (3%)

21. The melting points of a series of 18-carbon fatty acids are stearic acid (69.6°), oleic acid (13.4°), linoleic acid (-5°), and linolenic acid (-11°). What structural aspect of these 18-carbon fatty acids can be correlated to the melting point? Provide a molecular explaination for the trend in melting points. (4%)

22. What is the specific role of CO_2 in the biosynthesis of fatty acids? If a soluble liver fraction is incubated with $^{14}CO_2$ and other components required in fatty acid biosynthesis, does the resulting sterate contain ^{14}C? Explain. (4%)

23. Define or explain the following terms: (4%)

    A. Energy charge
    B. Respiratory control

24. The standard reduction potentials of the NAD^+/NADH and pyruvate/lactate conjugate pair are -0.32 and -0.19 V respectively. What is the standard free energy change $G°'$ at 25° for the following reaction? (4%)
    pyruvate + NADH + H^+ ———→ lactate + NAD^+
    (F=23062 cal/V. mol)

25. (A) What are enhancer DNA elements? (3%)
    (B) Why can enhancer work over a long distance to activate transcription? (3%)

26. What are the roles of recA and recBCD gene products in DNA recombination? (6%)

27. Describe initiation of DNA replication in E. coli. (7%)

28. The catalytic efficiency of many enzymes depends on pH. Chymotrypsin shows a maximum value of kcat/Km at pH 8. Detailed analysis shows that kcat increases rapidly between pH 6 and 7 and remains constant at higher pH. K_M increases rapidly between pH 8 and 10. Suggest explanations for these observations. (7%)

29. Eadie-Hofstee plot is an alternative to Lineweaver-Burk plot for expression of enzyme kinetic data. The plot is graphed V versus V/[S].
    (A) Derive the equation for Eadie-Hofstee plot.
    (B) Sketch the plots what would look like for a series of experiments at different concentrations of (a) competitive inhibitor (a) a noncompetitive inhibitor. (7%)

30. Briefly describe the biological function of following vitamins (6%)

    (A) Folic Acid   (2%)
    (B) Niacin (Nicotinamide)   (2%)
    (C) Phylloquinone (Vitamine K)   (2%)

31. What is the effect of each of the following inhibitors on the mitochondrial electron transport and oxidative phosphorylation. (8%)

    A. atractyloside
    B. antimycin A
    C. cyanide
    D. oligomycin

32. Describe either trans-splicing or RNA editing. (6%)