※ 考生請注意：本試題不可使用計算機 (考題包含 **Part A, B, C**) 請勿在本試題紙上作答，否則不予計分

Part A. 35 points (Q1-10, 1.5 points each)

1. The most important contribution to the stability of a protein's conformation appears to be the:

A) entropy increase from the decrease in ordered water molecules forming a solvent shell around it.

B) maximum entropy increase from ionic interactions between the ionized amino acids in a protein.

C) sum of free energies of formation of many weak interactions among the hundreds of amino acids in a protein.

D) sum of free energies of formation of many weak interactions between its polar amino acids and surrounding water.

E) stabilizing effect of hydrogen bonding between the carbonyl group of one peptide bond and the amino group of another.

2. Which of the following pairs of bonds within a peptide backbone show free rotation around both bonds?

A) C_α—C and N—C_α　　B)　C=O and N—C　　　C) C=O and N—C_α

D)　N—C and C_α—C　　E)　N—C_α and N—C

3. A sequence of amino acids in a certain protein is found to be -Ser-Gly-Pro-Gly-.　The sequence is most probably part of a(n):

A) antiparallel β sheet.　B) parallel β sheet.　　C) α helix.　　D) α sheet.　　E) β turn.

4. Analysis of x-ray diffraction data yields a(n) ___; analysis of 2D NMR data yields a(n) __.

A) electron density map; count of hydrogen atoms in the molecule

B) shadow of protein's outline; estimate of protein's molecular volume

C) table of interatomic distances; electron density map

D) electronic density map; table of interatomic distances

E) 3-d protein structure; 2-d protein structure

5. A monoclonal antibody differs from a polyclonal antibody in that monoclonal antibodies:

A) are labeled with chemicals that can be visualized.

B) are produced by cells from the same organism that produced the antigen.

C) are synthesized by a population of identical, or "cloned," cells.

D) are synthesized only in living organisms.

E) have only a single polypeptide chain that can recognize an antigen.

(背面仍有題目，請繼續作答)

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6. The energy that is released by the hydrolysis of ATP by actin is used for:

A) actin filament assembly.　　　　B) actin filament disassembly.　　　　C) actin-myosin assembly.

D) actin-myosin disassembly.　　　　E) muscle contraction.

7. Which one of the following statements is true of enzyme catalysts?

A) They bind to substrates, but are never covalently attached to substrate or product.

B) They increase the equilibrium constant for a reaction, thus favoring product formation.

C) They increase the stability of the product of a desired reaction by allowing ionizations, resonance, and isomerizations not normally available to substrates.

D) They lower the activation energy for the conversion of substrate to product.

E) To be effective they must be present at the same concentration as their substrates.

8. The concept of "induced fit" refers to the fact that:

A) enzyme specificity is induced by enzyme-substrate binding.

B) enzyme-substrate binding induces an increase in the reaction entropy, thereby catalyzing the reaction.

C) enzyme-substrate binding induces movement along the reaction coordinate to the transition state.

D) substrate binding may induce a conformational change in the enzyme, which then brings catalytic groups into proper orientation.

E) when a substrate binds to an enzyme, the enzyme induces a loss of water (desolvation) from the substrate.

9. Michaelis and Menten assumed that the overall reaction for an enzyme-catalyzed reaction could be written as

$$E + S \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} ES \overset{k_2}{\rightarrow} E + P$$
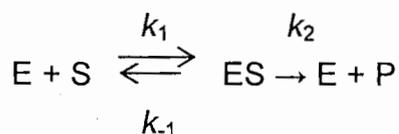
Using this reaction, the rate of breakdown of the enzyme-substrate complex can be described by the expression:

A) $k_1 ([E_t] - [ES])$.　　B) $k_1 ([E_t]-[ES])[S]$.　　C) $k_2 [ES]$.　　D) $k_{-1} [ES] + k_2 [ES]$.　　E) $k_{-1} [ES]$.

10. Which of the following parts of the IgG molecule are *not* involved in binding to an antigen?

A) Fab　　　　B) Fc　　　　C) Heavy chain　　　　D) Light chain　　　　E) Variable domain

11. Please describe how you would determine the K_a (association constant) for a ligand and a protein. (5 points)

12. What is the difference between general acid-base catalysis and specific acid-base catalysis? (Assume that the solvent is water.) (7 points)

13. Once a protein has been denatured, how can it be renatured? If renaturation does not occur, what might be the explanation? (8 points)

系所組別：生命科學系甲組
考試科目：生物化學及分子生物學　　　　　　　　　　　　　　考試日期：0224，節次：2

※ 考生請注意：本試題不可使用計算機 (考題包含 Part A, B, C)

Part B. 35 points (5 points each)

1. What is a chromatin? Describe the chromatin remodeling during transcription?

2. What is RNA interference (RNAi)? How is RNAi used to study the functions of genes?

3. Describe how does DNA polymerase III replicate the *E. coli* chromosome.

4. What is an operon? Describe the regulation of Lac operon in the presence of 1) high lactose and high glucose, 2) high lactose and low glucose, 3) low lactose and high glucose, 4) low lactose and low glucose.

5. Compare the differences between prokaryotes and eukaryotes by which ribosome recognizes the start codon.

6. Describe how do newly synthesized proteins fold.

7. Describe the protein degradation pathways.

Part C. 30 points (10 points each)

1. Explain how insulin and glucagon mediate blood glucose homeostasis (Hint: indicate signal transduction pathways activated by the two molecules).

2. A) Indicate the role of carnitine cycle in fatty acid metabolism; B) Describe the glucose–alanine cycle and its significance in amino acid metabolism.

3. Multiple answer questions (choice one best answer)

A).___. High levels of GOT, or Aspartate Aminotransferase in the blood serum, indicates:

     I). brain damage　　II). heart or liver damage　　III). torn tendons　IV). PKU

B).___.In the urea cycle, the second nitrogen of urea enters the cycle in the form of which of the following metabolites?　　　I) alanine　II) glutamate III) ornithine　IV) aspartate V) arginine

C). ___. The conversion of NH_4^+ to urea requires the equivalent of _____ ATP molecules.

     I) one　　II) Two　III) three IV) four　V) five

D).___.In eukaryotes, the degradation of fatty acids occurs in the _____.

     I) cytosol　II) mitochondrial matrix　　　III) inner membrane space

E) _____.Which of the following is elevated in plasma immediately after eating?

     I) lactate　II) glucagons III) free fatty acids IV) chylomicrons　V) acetoacetate